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All appointments in the League's field organization are made by the proper S.C.M., elected by members in each Section listed. Mail your S.C.M. (on the 16th of each month) a postal covering your radio activities for the previous 30 days. Tell him your DX, plans for experimenting, results in 'phone and traffic. He is interested, whether you are an A.R.R.L. member or get your *QST* at the newsstands; he wants a report from every active ham. If interested and qualified for O.R.S., O.P.S. or other appointments he can tell you about them, too.

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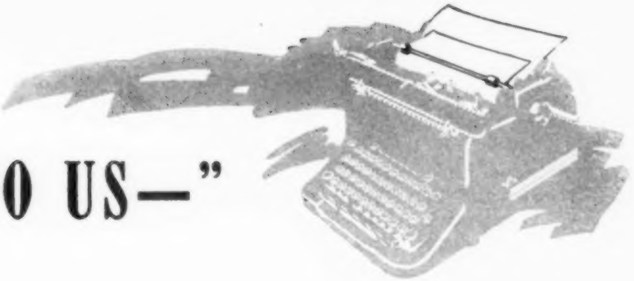


"IT SEEMS TO US—"

1938 IN REVIEW

As the clocks move swiftly onward to the end of an eventful year, it is interesting to cast a reflective eye backward and see where we got in 1938. It should help us in the coming year.

Amateur radio continued its slow and wholesome growth, at a rate just fast enough to be encouraging, slow enough to provide for easy assimilation. In the United States the number of licensed stations reached 50,000 for the first time. Despite immense congestion we have made some improvements in the ease and reliability of communication and are more than holding our own. This is accomplished through no slackening of general amateur spirit and activity but under quite the converse circumstances, for the contests and operating activities of the past year enjoyed more participation than ever before.

Mid-year brought the effective date of the inter-American treaties of Habana and the gradual putting into effect of their amateur provisions by early-acting countries. Here is the Western entente at work, emphasizing the community interest of the Americas in radio problems in a spirit that is a satisfying departure from the stock views of the Old World. The coming year will see us appreciate more and more this solidarity of western viewpoint, will see increasing liberalization of amateur communication. The great Cairo conference was successfully hurdled, amateur frequencies unchanged except in palpitating Europe. Our domestic regulations were revised late in the year in a way that has provided general satisfaction.

In the field of technique there is place for a mild glow of satisfaction over the increasing consciousness of the need for independent thinking by the individual amateur, presaging a return to more intelligent experimenting and development work rather than the blind copying of stereotyped styles. New apparatus appeared in such profusion as to constitute an embarrassment of riches — sturdier tubes, new tubes requiring remarkably low excitation, better and cheaper receivers marked by improved variable selectivity, a considerable trend towards manufactured transmitters both complete and in units, and many interesting auxiliary pieces of gear. Great interest prevailed in improved antenna systems and higher efficiencies were attained with closer-spaced systems, while amateur ingenuity produced many interesting solutions of the mechanical problems of rotatable systems. In transmitters themselves the trend has been distinctly towards the capacity to shift frequency quickly, involving not only band-switching exciters but ganged tuning of whole transmitters and a notable revival of self-excited and consequently flexible exciters. The latter have struck perhaps the sourest technical note of the year, figuratively as well as literally. Of undeniable value, they are probably here to stay but the average of their performance in 1938 was decidedly less than it should be, indicating the need for more study. And, as with any strange implement, we showed that we have not yet learned how to use them with discretion and courtesy, so that on this score we took a small step backwards which we must hasten to overcome. With commercial television looming, amateurs learned much about the technique of the new art from the triple standpoints of engineering interest, the probable construction of their own receivers and, of most consequence, as preparation for two-way television ultimately finding a place in amateur communication. U.h.f. technique bettered noticeably, while abnormal transmission conditions provided amateur radio an opportunity to contribute substantially to knowledge of the performance of the ionosphere.

Amateur radio as an institution awakened mightily to awareness of its public-service duty in emergencies. The southern California flood and the New England flood and hurricane provided the outstanding examples of organized amateur performance. 'Phone stations markedly improved their ability to serve in emergencies. Increased consciousness of the duty to be prepared led both to remarkable new government regulations to foster and protect our work and to the building of a prodigious quantity of new portable emergency apparatus, tested in the most successful Field Day event ever held. Administrative organization paralleled equipment building, so that the year-end finds us satisfyingly improved in ability to perform.

Within the A.R.R.L., mention also needs to be made of the holding of the first national convention in over a decade, with the greatest attend-

ance ever recorded at an amateur gathering; and of the commissioning of the new W1AW, model headquarters station of the League. An active membership was increasingly aware of its own responsibility in a democratic self-governing institution; gave intelligent and spirited study to its problems; was not appreciably misled by circus-barkers who, for their own ends, sought to break down the faith of amateurs in their own unique coöperative association. All of which augurs immensely well for the society's future.

Death seemingly selected from our ranks this year an unusual number of the shining marks she loves so well. A considerable number of names famous in our annals were added to the roll of silent keys, including that of our own late editor, Ross A. Hull. Hard-paid tolls exacted by unrelenting Time, they are the sad part of the 1938 story.

With increased verve and improved appreciation of its circumstances, duties and rights, amateur radio marches into 1939 with torches aloft, knowing that its devotees alone will determine what that year shall be.

MRI XMAS ES HPI NEW YR

It is that glad season of the year again when friend greets friend with warmest wish. It is notably true of the brotherhood of amateur radio, whose raw material is intracommunication. The members of the headquarters staff of the American Radio Relay League send cordial greetings and hearty good wishes for happiness, health and prosperity to the radio amateurs of every land!

Our New Year's present to you all is a new and better-looking *QST* and the promise of a journal constantly increasing in the interest and value of its contents. 73.

K. B. W.

Strays

The other night we heard a chap on about 14,404 kc., calling CQ and asking for a frequency check, explaining to the world that he had a new crystal and wanted to know whether it was in the band or not. Hi! Do you reckon the monitoring stations'll give him the info he wants? And will he have to do some fast thinking when the F.C.C. asks him for a description of his frequency-checking equipment!

Use of old half-tone cuts (copper) for Faraday shields is suggested by W2WD. As it is necessary to visit the printer to obtain the material, W2WD suggests further that the printer be persuaded to cut the slots to within half an inch of one edge with his metal saw. The shield is then completed — unless the ambitious ham wishes to rub it on a sheet of sandpaper to make a more finished job!

According to a college paper description of W9ZOL, the station of Synton radio fraternity at the University of Illinois, ". . . the power input to the one-hundredth tube in the final stage of the transmitter is 300 watts." Apparently, the linotype operator hadn't heard of a 100-TH tube!

Ex-W4HJ, one of the operators at the Asheville, N. C., Police radio station, sends the following: "Our system at WPFS employs 'two-way' communication between the cars and headquarters. The cars are identified by various numbers, and it so happens that the county sheriff's car is number 88. Imagine the amusement of visiting amateurs when they hear a decidedly bass and very much businesslike voice calling, '88 to headquarters, 88 to headquarters. . . .'"

Calls Heard

Tel-Aviv, Palestine

(14-Mc. band, Oct. 16th, 5-7:30 p.m. EST)

W1FH, GHK, BFT, LAX, BHM, BA, CCK
W2GUD, BNX, AGW, AAS, FKE, HSZ, FZI, BWE, AJ, RS, AOA, APU, LND, CBL, IYO
W3CKA, COD, FFH, GAU, GTL, GWL, GYL, GWJ, GQG, JN
W4DWU, FFT, EAK, AQL, FDA, EPL, EYI
W5BFX
W6MJK
W8BTI, DFH, CRA, LBD, LIW, GMZ, JAX
K4AOP, KD, FCV, FHR
K5AU
NY1AB
CM2GR

Beirut, Syria

(14-Mc. band, Oct. 17th, 5-6:30 p.m. EST)

W1DBS, LAX, AXX, GNE, KHV, DKD, LMO
W2EDM, KEZ, EGI, IYO, HXT, AOA, FKE, KJY, HQX, ISU, BHW, GSA
W3EUJ, EZN, HJL, US, CRW, BHV, GWJ, FQO, AOO, GTL, GTR, QP, WU
W4DE, FJI, CFJ
W8GMZ
W9KFL
K4KD, FCV
K5AA
NY1AB

— *Max Buch, W2AMA*
3rd Op., Aboard S.S. *Excalibur*, KGWT

Bound Volume XXII of QST

We have a limited number of Bound Volume XXII of *QST*. This volume is made up in two sections, each containing six issues of 1938 *QST*. Handsomely bound and gold imprinted the complete volume is priced at $6.00, postpaid.

A group of North Greenland Eskimos enjoying the noon-day sun. The polar bear and fox-skin pants still stand guard against chilly nights, even in midsummer. The sport in the left foreground with the "bowl" haircut has evidently blown himself to a white shirt and suspenders at a Danish trading post.

Ham at 30° Below

Being the Musings and Random Comment of an Amateur Radio Operator with an Arctic Expedition Signing OX2QY-W1OXAB

BY A. G. ("GERRY") SAYRE,* W2QY

REMEMBER that QSO we had from above the Arctic Circle?

You probably envied me, then, sitting in my snug berth and working the world. To some extent you were right—from the number and variety of the contacts available it was a ham's heaven up there near 80° N.

But there is another side to the story, too—a story of headaches and heartaches, of hardship and downright misery. It is my hope to bring you something of both sides in this story.

Picture a typical night's operation at OX2QY-W1OXAB-WAWG: DX'ers calling us by the dozens. I try to answer each of them in turn and complete an FB QSO in the short time at my disposal. But Father Time marches right along—the supply of gasoline is none too large and must be conserved—so we cut it short. Boy! What a thrill to hear the lads calling and what a pity when I am unable to answer each in turn. Stations five deep on various frequencies—try to get a solid QSO out of it all! It really was hard, when the allotted time had been used up and hundreds were still calling, to have to close down and say goodnight.

That characteristic waver you reported on our signals . . . yes, you had it, too. Hollow-sounding, with rapid fluctuations in signal strength. Must be characteristic of the paths over which the signals were travelling . . . there's something worth noting. Looking back over it, we see that almost invariably the stations we contacted best had higher power and, most important of all, they had some form of special antenna to throw the signal up to us, to enable them to reach out and over the interference.

So it went, night after night. Ah, a new station calling us! We go back, give him a report, and—bang! He is wiped out by QRM from someone else QSY'ing right on his frequency trying to get a new country. Wonder if this bedlam will ever let up? . . . Very little static was experienced, except during winter periods. When dry, hard snow and ice particles drifted down from the plateau above us and struck the antenna and feedline, the discharge brought not only severe bursts but substantial jolts on contact. Frequently it jumped over in the receiver, and even a few times in the final tank condenser. This was our worst trouble. Hash from the three windchargers which operated the 32-volt system, from the radio engine ignition and also the exciter and generator, was minimized by filtering.

It was interesting, too, to note the variations in signal strength, before, during and after magnetic disturbances or storms. Signals are supposed to increase in strength just preceding and just following such storms, and that seemed to check quite well with our log. Complete fadeouts always brought home to us thoughts of other years when men had spent the long Arctic night without radio to furnish them with the latest news, or a world series baseball game or the major football game of the week. Possibly it might be Jack Benny or the Breakfast Clubbers to whom we would turn for our amusement. To miss them and others left our day only partly filled.

Maybe I ought to go back to the beginning, and set the scene a bit, so you can appreciate that.

*Milton, Rock County, Wis.

It started on July 1, 1937. That was the day the MacGregor Arctic Expedition sailed away from Port Newark, N. J. The radio equipment had not been completed or tested. The first day I was assigned the job of installing the 120-volt lighting system throughout the ship. But the fumes from leaky exhausts and seasickness got me. Sick was no word for it—I was out!

The first leg of the trip was completed July 9th when we docked at Lunenberg, N. S. There, Donald Whittemore, W2CUZ of N.B.C. and I got the rigs going after infinite checking and rechecking, building and rebuilding. VE1CD, VE1GC and VE1GH deserve a lot of credit for their aid and thanks for their hospitality. Finally, everything was working on all frequencies. We put up the ship's antennas there, too—a vertical Marconi and a 17-Mc. doublet.

On the 14th we left Lunenberg for Sydney. There we tested with WCC and got to work on the 'phone. VE1CR helped in true amateur fashion. Don Whittemore left us at Sydney, and on July 20th we shoved off again. What a treat it had been to meet such hospitable people! Everyone in Nova Scotia had treated us like brothers. But now we were heading north again, out through the straits of Belle Isle and into the cold Arctic seas. The rig was running 500 watts input on c.w., feeding the vertical Marconi.

The water was warm in the Straits and many codfish could be seen on the surface. We saw a beautiful aurora in color the night of July 24th. What a sight! One of the brightest and most brilliantly colored of the entire trip—never saw anything like it in the States!

But radio conditions were punk. Had an insulator burn up—the first trouble of that sort. Above Battle Harbor, Labrador, it started to get cooler and we sighted our first icebergs. A few days later, at about 55° N., it was appreciably colder—about 42° *F.*—and we saw lots of growlers and a few bergs. July 31st brought us rough going, with the seas carrying away bowsprit lines and bobstays. We headed across toward Greenland to get favorable currents. Too rough for radio! On August 2nd we sighted the coastline of southern Greenland and the seas began moderating. For days on end the high, snow-capped, barren, bleak, rough, rocky fiorded coastline was then visible. Sea birds, icebergs, fresh codfish from fishing vessels on the banks—these were the events of our lives.

On August 4th the radio engine began to balk. Valve adjustment was off. Code signals on the broadcast band surprised me; found they were fishing vessels working each other with low power. More engine trouble a couple of days later. I noted a peculiar greenish color to the sky just at the top of the icecap over Greenland—no, I wasn't sick, either! At Fairhaven, headquarters for the Danish fishing fleet where we went to replenish our water supply, we lost our anchor due to the great depth. One of the crew was overcome with exhaust gas, gave us a bad time. . . .

August 7th was a day of troubles. I tried to get through on schedule but a downhaul line was fouling the antenna system. Some fun! Finally we got going, then ran out of gasoline in the middle of a QSO. Boy! Receiver went dead, but new rectifier and output tubes fixed that and we finally got going again.

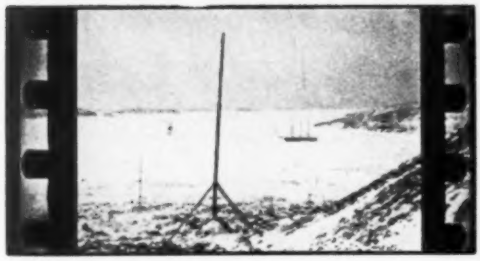
The next day we crossed the Arctic Circle. The sky was a variety of hues—what a picture! Water black, shaded to green, sky to the west full of variegated tones, to the east covered with a purplish tint. Radio conditions improved that day, too.

On August 13th, following a flock of radio troubles and QSO's with W1OXDA and W9BBU, we put in at Idglorssuit on the east shore of Hare Island. This is the place where Rockwell Kent spent a winter and based the story of Salamina on his experiences, you know. Glaciers, icebergs, the Eskimo settlement, flowers still in bloom but no trees—all the color one would want. We delivered Mr. Kent's presents to the natives, and were they happy! Saw our first kyacks, and the accurate harpooning at either birds or seal. These people are unique, having small, dark, squat bodies, plump, round faces, and cheerful smiles. They love to have visitors—had a coffee party and dance for us that night.

We got some dogs there, and then set out for the North again—through the thickest pack of icebergs encountered on the trip. The absence of static is noticeable—in contrast to WHD's plaint that thunderstorms made it hard to read us back in New York. On August 17th, north of 73°, we sent the first messages from the crew to W8ITK. Vibration of the ship's motors shook the final grid coil from its mounting; it broke two RK-20's as it fell. Just another thing to do better next time!

For the next ten days or so we struggled further north. The temperature grew colder, hanging between 32 and 44° *F.* Then we struck floe ice and freshly-frozen layer ice. It began to look as though we would not reach our destination at 82° N. Finally, unable to get across to Ellesmereland, we turned back and entered Etah fiord. There we

An enlargement from an 8 mm. film which shows in the foreground the rear stick that held up the rhombic. The ship can be seen frozen in the ice.



went ashore to stretch our legs for the first time since Sydney!

Etah began to look attractive as a headquarters. It was a large fiord, and there were little flowers still blossoming there. A 14×20-foot cabin left by the British Arctic Expedition would make a good nucleus for the headquarters. So on August 29th we started the tedious, heavy job of unloading ship and ferrying the gear and supplies ashore in boats. After tentatively deciding on a possible location for a rhombic just east of the shack, we lost 4000 feet of antenna wire overboard. I honestly felt like weeping!

Two days later we were blown out of the fiord by strong gales. The anchor was out and one hawser was attached to a deadman ashore, but the hawser broke and the anchor dragged, and out we went. The engines were started, and barely kept us off the rocks. The gales were too strong to permit re-entry and the way to the north was blocked, so we just tacked back and forth until the winds died.

But our troubles were not ended. The next day, on again entering Etah, one propeller fouled with the line. Then the other motor backfired and caught fire. We lay to and all hands fought desperately with water, Pyrene and sand. We tried not to think of the 3000 gallons of gasoline in the hold! Finally the fire was put out, and an outboard motor on a dory pushed us into the fiord.

Do you begin to see now what I mean, when I say there are two sides to the story? If you don't think it's a lot more fun to sit back home in the comforts of civilization and work the expeditions, you're crazy!

However, whatever our feelings, we had work to do. The remaining stores were unloaded and installations completed. Most of the details of the equipment were given in the yarn I sent down by radio to the boys at *QST*, which was printed in the December 1937 issue, so I won't go into that again.

But I do have a few observations and explanations I should like to make. First of all, we want to thank all the stations, both commercial and amateur, for their splendid coöperation all the time we were out. Such amateurs as W2CIF, W3DPU and W8CJJ were especially helpful throughout the entire year. QRN, QRM, QSB and skip all caused repeats and delays, but nevertheless we cleared the hook. 'Phone schedules with W3DHM, allowing Mrs. MacGregor and her daughter to talk with the Commander, were usually very successful. W2JKQ was also of great service in piping us through to parents and families. All in all, we appreciate ham radio far more than we did before we went "up North"!

Conditions seemed to be quite different from those good old days when Don Mix took WNP up there in 1923–24. Then, of course, they worked 220 meters from 10 P.M. to 5 A.M. We could hear regular broadcast signals only a few times between Sept. 1st and May 31st, even with the gain of the big rhombic ashore. But the 14-Mc. band was consistently open most all night long and throughout the daytime. In the region between 1500 kc. and 7000 kc., however, no signals were heard at any time day or night, winter or summer—during the time we were ashore. Only rarely did anything come through even on 7 Mc.

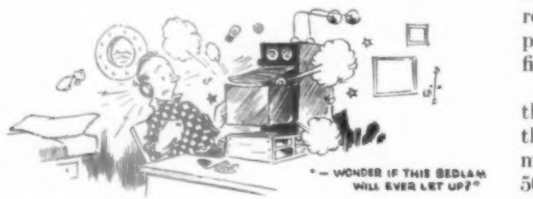
Between 9- and 18-Mc. signals were heard practically every day, with variations for time of day, season and fadeouts. Conditions in this region seemed similar to those back home. Ten-meter signals were never good, but on a few days wavered in and out with deep fading. No signals were heard on 56 Mc. This collapse on the part of both the lower and the higher frequencies was a source of considerable surprise to us, since we had expected to use both. Incidentally, two different makes of superhets and an SW-3 were used, so the receiver can't be blamed.

We had anticipated a large amount of work with antennas, but when that 4000 feet of wire went down our good intentions went also. There was barely enough left to erect the diamond. We did put up one doublet, but it blew down and did not give us much service. Of course, the rhombic gave a huge gain on both transmission and reception compared with the ship antennas.

On checking our log with the magnetic conditions as observed by RCA we found substantially complete agreement. (A complete summation of all our findings is not yet available. We are now investigating many angles.) Incidentally, during the April 1938 fadeouts (12th–17th) we are told that our magnetic recorder showed the strongest magnetic storm ever observed at any point on earth to date! Other complete fadeouts occurred on January 16th–17th and February 7th.

There were months when VE1-2-3 and W1 were barely audible. Then, of course, other sections would come through in great style. Sometimes only VE4-5 and W6-7 would be good. Schedules would be arranged only to find conditions such that nothing could be received. It's all in the game!

Input to the Gammatrons varied, but finally we settled on 400 watts input—200 ma. at 2000 volts—with plenty of bias to hold them down. This was equally satisfactory on ham and broadcast work, press and commercial schedules, 'phone and c.w. No trouble was experienced in getting the rhombic to load up on any of the frequencies used, ranging from 8655 to 17,310 kc.



Our main purpose was to report the daily weather summary to the U. S. Weather Bureau in Washington, to send a weekly magnetic summary to the Carnegie Institute of Terrestrial Magnetism in Washington, to deliver at least one NBC broadcast a month, and to furnish press news to the *New York Times'* station, WHD. After all of these were served we might have an hour for amateur schedules and general contacts.

I hope that all of you appreciate just how things go on an expedition. They are not so smooth and rosy as they are painted before you leave port! Hamming is the last thing the expedition proper cares for. On the other hand, we had to rely on amateurs for many of our contacts. Our hats are off to you! We owe all of you much. That applies especially to the gang at W2CIF. We could always depend on you to handle whatever we needed, and all of us grew to know that 2500 miles away there were friends on whom we could rely. Our thanks, too, to W2BCR for his invaluable aid and to W3DHM. Space does not permit the full acknowledgment of our debt to all of you. There are many more who handled lesser amounts of traffic to whom we owe a similar tribute.

A week after the anniversary of our departure from New Jersey we set sail from Etah on the return voyage. The fiord ice had just opened to let us out. The journey home occupied the next three months—months of hard work and slow going and an occasional highlight which I will try to relive for you briefly.

Arriving at Thule on July 12th, we were met by Governor Neilsen and his staff, and by the British Arctic Expedition boys who were waiting for their ship. A few days after leaving there we were caught in an ice pack, west of Melville Bay. Radio conditions were poor. I got out the portable gear and fitted lifeboats. Finally, on August 1st, after more than ten days of struggle, we were free of the pack near Hare Island. Soon there was fresh codfish again—and mighty welcome, too!

Engine troubles came to a head in early August, with water and spray drenching it continuously. On August 9th we passed southward over the Arctic Circle, having been north of it just a year and a day! Winds were sluggish, radio conditions poor. A few days later I climbed the rigging and secured the concentric feedline which had worn out its lashing in the roll of the ship at sea. A nice job for a landlubber, pitching and rolling around up in the sky! Huge numbers of petrels, kittywakes and gulls around all the fishing banks. . . .

Auroras all the way down. . . . At 61° N. the first regular b.c. stations started to come through. . . . The ship leaked badly, and one man was continuously on the pumps. . . . At 50° N. off Fogo Island, 4-Mc. ham signals started to come through again. . . . On August 30th we landed at St. Johns—and were we happy to be back ashore again! Fifty-four days at sea. . . . I can't tell you of all the hospitality of the St. Johns' ham crew. VO1H, VO1A, VO1G, VO1I, VO1P, VO1S—they all went out of their way to entertain and assist us. Wonderful ham spirit exists there—and wonderful equipment, too, considering the cost of gear up there. . . .

After 18 days in St. Johns, during which the ship was completely overhauled and outfitted, we sailed out of this oldtime fishing port. We rounded Cape Race next day at noon, and then calms and a high pressure area set in. This high-pressure zone apparently held the hurricane which hit Long Island and New England and sent it over land, doing all the damage.

Finally, on October 14th, having lost a mainsail in the meantime, we held our last QSO with W2CIF while entering the Narrows of New York harbor, and then closed the rig down for good.

There are plenty of things that one learns on a 15-month jaunt of this sort. One notable point is to protect all equipment against condensation of moisture. Otherwise every time the switch is turned on, something blows up. We tried chemicals to dry the air, larger tank condensers, and other methods. Finally, we adopted the system of pre-heating the operating shack before each schedule period. The warm air absorbed the condensed moisture and permitted satisfactory operation. Ample safety factors are, of course, essential. It will be hard for you to visualize conditions as they were. When your bunk gets damp and mildews, when your clothes get sticky and clammy as you hang them up, when

(Continued on page 106)

Feeding Vertical Antennas

★

BY ARTHUR LYNCH,* W2DKJ

★

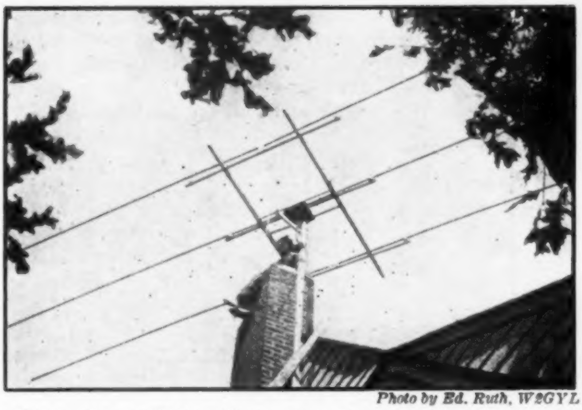


Photo by Ed. Ruth, W2GYL

The author and this chimney have been associated in a good many antenna experiments, which probably accounts for their obvious palishness. This photograph has nothing to do with the subject matter of the article, but shows a new six-element rotary beam which has been giving an excellent account of itself.

Methods of Using Vertical Elements Singly, and in Combination to Form Simple Directive Systems

It seems strange that there should be any problem regarding the proper method of feeding a vertical radiator, yet that such a problem exists is most certainly true. After all, except for a few comparatively unimportant details, there should be nothing more to feeding a vertical than feeding the more familiar horizontal types.

In giving consideration to the method for feeding any particular antenna, we must give some thought to its physical characteristics. It is well-known that the physical dimensions, for an antenna which is to be used on a certain frequency, will vary somewhat as a result of the proximity and the character of other bodies which may be in the active field of the antenna. The height above ground and the character of the ground have marked effects. The current literature is so full of information covering these important subjects that we will skip it entirely. It is mentioned only to indicate that it has not been given attention in the following text and that the dimensions given here cannot be set down for rule-of-thumb guidance, but are intended only as guide posts for determining the starting point for the particular antenna and feed system which will best fit into a particular group of conditions.

It is not to be assumed that any of the information given here is especially new; in its fundamental form, most of it is to be found in the *A.R.R.L. Handbook*. Those novel kinks, such as are illustrated in some of the last figures, are but conveniences which make for better operating conditions where it is necessary to make compromises, forced upon us by lack of space or local restrictions of one form or another.

* 136 Liberty St., New York City.

The Quarter-Wave "Marconi"

Several years of operating ultra-high-frequency equipment in airplanes and cars, to say nothing

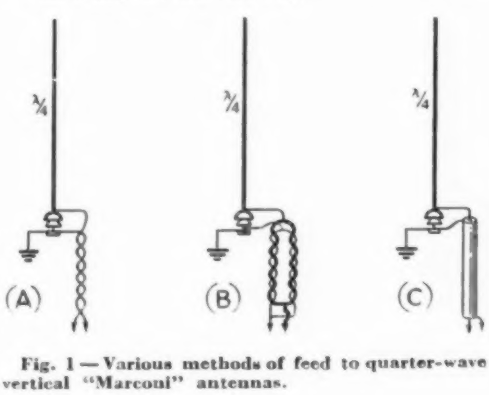


Fig. 1 — Various methods of feed to quarter-wave vertical "Marconi" antennas.

For some mysterious reason the business of supplying power to a vertical antenna assumes the aspect of a Problem to a good many hams. If W2DKJ did nothing more than dispel the fog which seems to surround that region between the transmitter and the vertical radiator, this article would be well worth while. But he goes farther than that, bringing out some points which are decidedly worthy of consideration by the antenna-minded chap who has to worry about space. Good practical dope, tested at many different stations and locations.

of yachts and high buildings, has brought us to the conclusion that too little attention is given to the quarter-wave "Marconi" antenna. For most mobile purposes we have found it to be ideal, and certainly much less trouble to install and use than

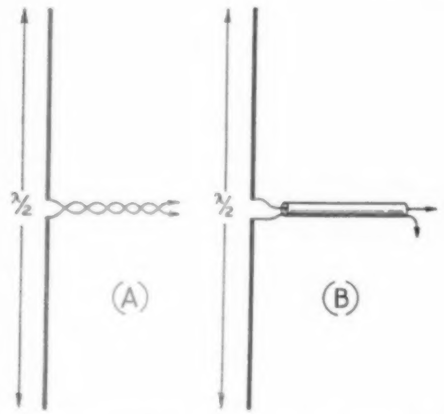


Fig. 2 — Center feed through twisted and concentric lines.

any of the more elaborate types. Then, too, we have never found any of the others, except beams, to perform better. A telescopic type of broadcast antenna, extended to approximately 4 feet, was hastily attached to a wooden cross-member of an airplane and the point was pushed up through the skin. It was installed with a view to making a single flight. It stuck with the ship, through all kinds of weather, for more than a hundred thousand miles. Actual tests made later with other types showed no superiority in performance electrically, and all of them were a headache mechanically. Very much the same story can be told of the job on our car.

So, when there is not much room and you want to put up an aerial which is the least conspicuous, give some consideration to one of the arrangements shown in Figs. 1. They are the shortest units possible for good performance on a particular band and, since they are to be current fed, the insulation problem is not a serious one.

Also, the impedance between the base of such an antenna and ground is in the vicinity of 35 ohms.[1] Some of the better twisted-pair transmission lines have an impedance in the vicinity of 75 ohms. If the line is to be short and the power not too high, the mismatch of impedance, when the arrangement shown in Fig. 1-A is used, doesn't really cut much ice. Theoretically, yes; practically, no! If you want to run a longer line or want to run more power, or if you're just fussy about efficiency, the arrangement shown in Fig. 1-B will fill the bill nicely for you. Here two twisted-pair lines are run in multiple, making certain that they are of the same polarity,[2] and you have cut the surge impedance in half and doubled the power-carrying ability of the line. You have not, however, cut down the dielectric loss per foot in the line itself,[3] although the temperature rise will be less if the line is being overloaded.

In Fig. 1-B we have indicated the method for feeding a vertical quarter-wave "Marconi" with a concentric or coaxial line. If a line of 30 or 35 ohms is available it will do the trick very nicely, but the mechanical difficulties which are generally encountered in making such a line are seldom justified by the improvement in performance, if any.

In all three of these cases we have shown one side of the transmission line grounded adjacent to the base of the antenna. It doesn't seem to make much difference if this part of the line is permitted to hang in thin air. The line may, of course, be random length.

For most practical purposes, a quarter-wave radiator on 5 meters is 4 feet, 10 meters is 8 feet, 20 meters is 16 feet, 40 meters is 33 feet, 80 meters is 66 feet, and 160 meters is 133 feet.

Half-Wave Dipoles

Where two quarter-waves are used, as in Fig. 2, we have the typical half-wave dipole. In free space, where the antenna is not influenced by the ground or surrounding objects, the impedance at the center is approximately 72 ohms. This is,

[1] W. C. Tinus, "Ultra-high Frequency Antenna Terminations," *Electronics*, August, 1935.

[2] I.e., each wire in one feeder connected to the corresponding wire in the other. The wires usually are coded in a two-conductor cable. — Editor.

[3] S. W. Seeley, "Match and Mismatch," *QST*, November, 1937.

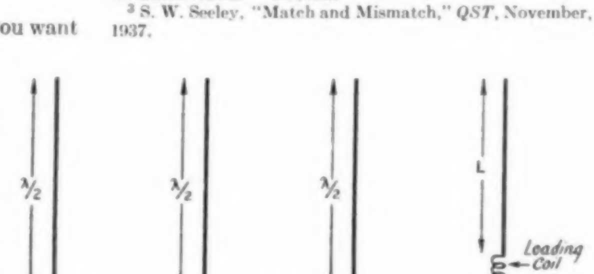
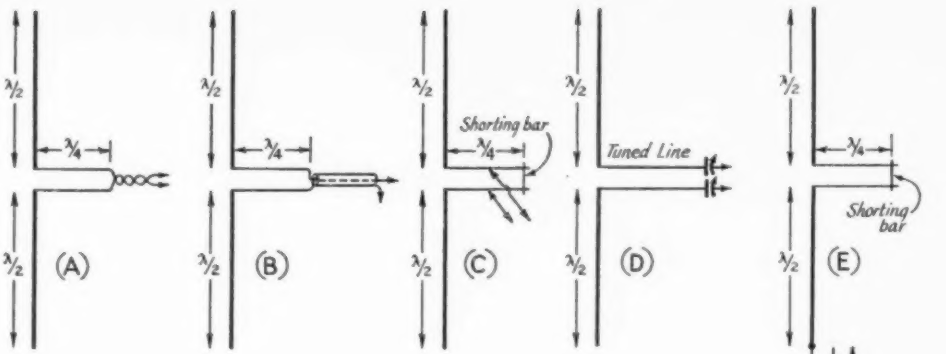


Fig. 3 — Representative end-feeding methods. In "D" the inductance of the loading coil should be adjustable.



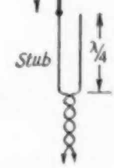


Fig. 4 — Phased systems using matching stubs.

of course, a "perfect" match for some of the transmission lines which have been designed to have an impedance of 72 ohms. Twisted pairs (within the limits of their power carrying capacity), flexible coaxial conductors of the proper impedance, or solid coaxial lines may be used to feed this very simple type of antenna.

It should be remembered that all coaxial lines are not of the same impedance and that the proper line for a given type of antenna feed system should be used. This is equally true of twisted-pair feeders. They will be found to vary from about 65 to 170 ohms. This variation is not very important if the line is not to be too long and is not made to carry a power overload.

The Half-Wave "J"

Because, no doubt, of the popularity of the "J" type of antenna for police high-frequency installations, many amateurs are using this aerial in one form or another. We have played some nasty tricks on this type of antenna, and it seems to have taken the abuse very nicely. A unit of the type shown in Fig. 3-A was made up of rather heavy wire. A rope was fastened to an insulator attached to the top, and the whole business was run up to the top of a yacht's mast, among steel shrouds, etc. The lower end was held in place by winding the twisted-pair transmission line up and down over a belaying pin, which was brass and grounded. The line was run some 20 feet along the deck and into a cabin window. Using only a few watts, we were able to contact other installations of the same character, on 5 meters, up to about 35 miles. On the lower-frequency bands, the results to be obtained are very satisfactory.

The simplest way to get such an antenna started is to make the length 0.97 × a half-wave (492,000/*f* in kc.) and the matching section can generally be cut a quarter-wave long.[4] If it is possible to shock-excite the whole system the point of highest current may be found on the matching stub, and will be the point where a low-impedance transmission line should be attached.

There is little difference between such a simple system and the one shown in Fig. 3-B other than the use of the shorting bar and the open-wire higher-impedance transmission-line. The shorting bar is placed in the stub, at the point of highest current, as indicated by a current-squared galvanometer, and the transmission-line is slid up and down above the shorting bar, with the power on, until a point is found where the standing waves on the line are minimum or disappear altogether.

For a permanent installation, where objection will not be raised to the unsightly appearance of the open wire line, particularly where power above 200 watts is to be used, this arrangement is to be preferred to the simpler system at 3-A.

Of course it is always possible to use "Zepp" feeders with almost any kind of vertical antenna, and the arrangement shown in Fig. 3-C is suggested as a typical case. For full details on the use of this kind of line reference should be made to the *A.R.R.L. Handbook.*

Where operation is desired on more than one band, it is possible to do a fair job by taking advantage of the system shown in Fig. 3-D. A loading coil is inserted between the base of the vertical radiator and one end of the "Zepp" feeders. If the loading coil is of the flat spiral type, the positions for the tuning clips can be marked on the copper strip, for the various frequencies desired, so that the adjustment may be made with the least loss of time.

A new setting of the variable condensers in the feeders will need to be made and they may be marked in a similar fashion. The condensers may be adjacent to the final amplifier or in any other convenient part of the line, depending on the

[4] More commonly, the factor is taken as 0.95 for the half-wave antenna and 0.97 for a two-wire open feeder. In any event, if exactly the right length is wanted the system had best be adjusted experimentally. — EDITOR.

length and type of tuning (series or parallel) used. A good arrangement for this type of antenna is to place the loading coil in a weather-proof housing which is set right at the base of the vertical radiator.

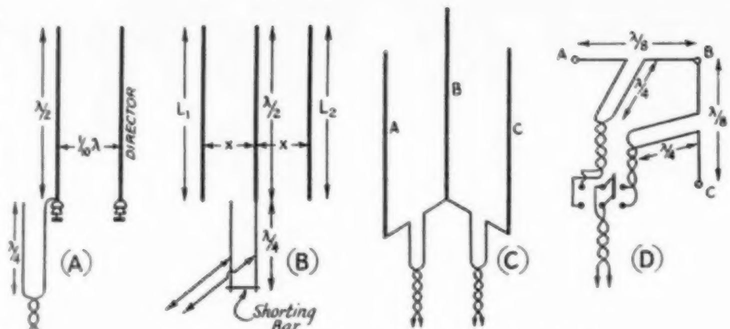


Fig. 6 — Simple directive systems using vertical elements.

Two or More Half-Waves in Phase

A lot of the energy which is shot up at too high an angle to be useful, when one of the foregoing vertical antennas is used, is pulled down and shot out in more desirable directions when half-wave antennas are operated in phase and stacked one above the other. Everything else being equal, the radiation from one of the systems shown in Fig. 4 should be just about 150 per cent that which could be had from any of the other aerials we have considered.

Any former remarks concerning matching stubs and transmission lines may be considered as applying directly to these aerials, in just the same manner. The method of feeding from the end, as shown in Fig. 4-E, may be a mechanical convenience, but it is likely to produce a system which is not as symmetrical as the center-fed methods. Various types of transmission-lines may be used in connection with the matching stub (Fig. 4-E) as outlined previously.[5] However, it is desirable to leave off the stub and the transmission-line and find the correct position of the shorting bar on the phasing section, by shock-exciting the antenna and locating the point of highest current in the phasing section with a current squared galvanometer. Then the stub may be attached and fed in the same manner as with any other form of aerial.

Additional half waves may be added, if additional phasing sections are used, but they are not very useful if the entire system is not more than a half wave above ground at its lowest point.

"Pitch-fork" Bi-directional Half-wave Beams

In locations where space is limited, and where a bi-directional antenna may be a convenience, we should not lose sight of the possible gain to be had from the "pitchfork" (Fig. 5) over the ordinary type of vertical antenna. In many cases, it will be an improvement over two half-waves in phase, for the reason that it tends to put the signal where we want it. For receiving, it tends to cut out interference from stations in undesired directions as well as increasing signal strength from those stations in desired directions.

Since the spacing between the two vertical sections is only an eighth wavelength and the matching stub is only a quarter-wave long, it is possible to set such an array above an apartment-house roof, using self-supporting vertical rods. The entire assembly does not become too cumbersome, even though it is used on the 20-meter band, when the vertical elements become about 29 feet high, with a separation of about 8 feet. Some of the more ingenious fellows have made beams of this nature rotary, but where rotation is possible, we prefer the arrangements shown in Figs. 6-A and 6-B, for reasons outlined later.

In locations where rotation is not possible and a single aerial is all that can be used, the pitchfork has its advantages if we choose the two directions with care. If two such beams can be set up a reasonable distance apart, we can cover all directions with a great deal more efficiency than would be

[5] Where a twisted pair or coaxial line is series-fed into the low-impedance point on the stub, the exactness of the match will depend upon the surge impedance of the matching stub. The mismatch with a 600-ohm stub should not be greater than 2:1, which is not serious, under ordinary circumstances. Closer match can be secured by adjusting the conductor spacing of the matching stub to minimize standing waves on the transmission line. — EDITOR.

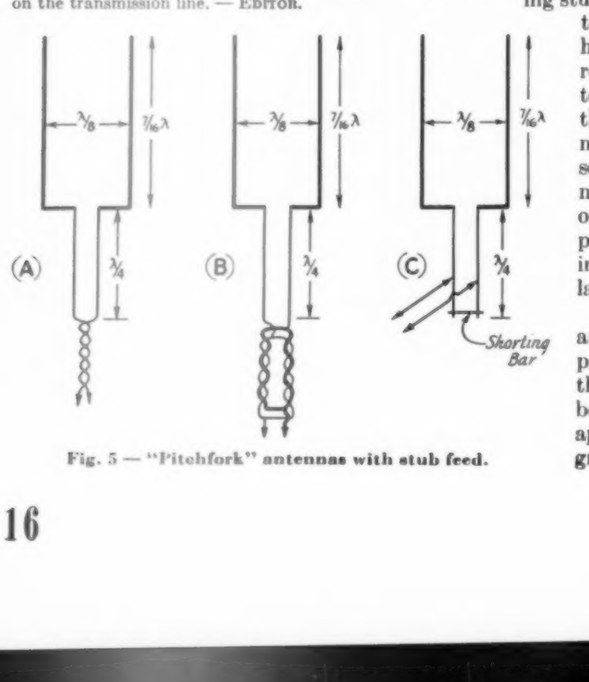


Fig. 5 — "Pitchfork" antennas with stub feed.

The vertical two-section "W8JK" rotatable beam installed at W2AZ. Self-supporting 20-meter half-wave elements are used. The beam is bi-directional and the antenna need be rotated only 180 degrees for complete horizontal coverage.

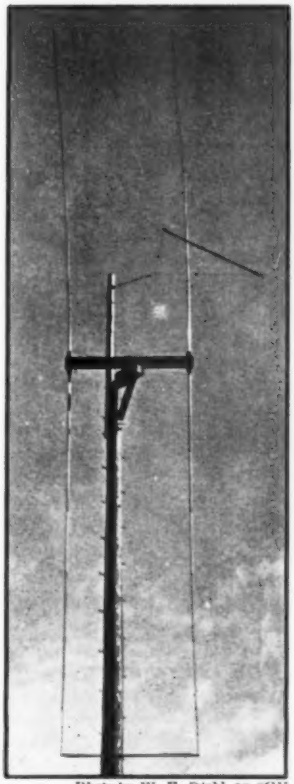


Photo by W. F. Diehl, ex-2CY

possible with any of the single units previously considered.

The use of three vertical elements for making a fixed beam which covers four directions, with fair results, is shown in Figs. 6-C and 6-D. It will be seen that the center unit is used with both systems and we have, in effect, two distinct beams at right angles to each other and having two distinct feed systems. The results which have been produced by this layout have been most encouraging. While they are not so good as those to be had from two similar beams a reasonable distance apart, and while it is possible to find current in the vertical element which is not in use, the performance is distinctly better than we thought it would be. This holds true for both transmitting and receiving.

The double-pole double-throw switch used to make the experiments on the 10- and 20-meter bands was located near the transmitter. It is thought that a suitable switch located at the base of the antenna, and remotely controlled, would bring about even better results.

One marked advantage of this double pitchfork beam was its gain over a single half-wave radiator for use in covering all directions simultaneously. To accomplish that result it was only necessary to feed the two transmission lines in multiple. The advantage of such an arrangement for general calling purposes is obvious.

As outlined before, any desirable transmission-line may be run to the quarter-wave stub, if the conditions for using those lines are met.

Vertical Rotary Beams

It is a bit difficult to know just where to give credit for the various ideas which have been conceived and worked out by so many investigators, and it is likely that much credit is given to some who have not been the first to use various arrangements because those who have actually been first have not made their findings known. In outlining the next two types of arrays, we wish to thank Lawrence M. Cockaday, W2JCY, and Frank Lester, W2AMJ, for much of the electrical and mechanical work which they have done and for the information this work brought to light.

Many investigators have had the impression that Brown's paper before the I.R.E. which so ably covered the subject of half-wave radiators and close-spacing,[6] was intended to convey the idea that his findings would apply only to the use of a single radiator and a single director or reflector. It has been generally thought that the use of both director and reflector would not be an advantage. We think that what he intended to convey was the thought that the actual results which he described were found to be true under a given set of circumstances and that other sets of circumstances had not been investigated. In any event, there is no doubt now that both the director and the reflector, used with close-spacing and a half-wave radiator, provide better performance than either of them alone.

The mechanical difficulties usually encountered with nearly every type of rotary beam are reduced to a minimum when the arrangements shown in Fig. 6-A and 6-B are employed. In the former, we have shown a half-wave radiator with a director and no reflector, while in the latter we have shown the manner in which both may be used. Again, all the information regarding transmission-lines and matching stubs applies to this case, and two of the simpler methods have been illustrated.

It will be seen that changing the direction of radiation with this type of beam depends entirely upon the location of the director and/or reflector and that the radiator, matching stub and transmission-line remain fixed. The mechanical details for bringing this condition about are obviously simple, even where it is desired to use the three-element array on 20 meters.

Single-Wire Feed

One of the least used and one of the simplest methods of getting energy from a final tank circuit to an antenna is

(Continued on page 108)

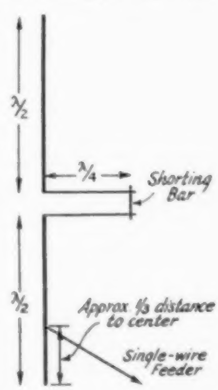


Fig. 7 — Half waves in phase with single-wire feed and phasing stub.

[6] G. H. Brown, Proc. I.R.E., January, 1937.

★ WHAT THE LEAGUE IS DOING ★

League Activities, Washington Notes, Board Actions—For Your Information

MORE EXAMINATION POINTS

The Federal Communications Commission has drawn new 125-mile circles around three of its sub-offices: at Savannah, Ga., Tampa, Fla., and San Diego, Calif. The Class C examination is no longer available within these areas. Frequent examinations will be held at these offices for Classes B and A, but by special appointment with the office, not on regular schedule.

Examinations are now also available at the sub-office at Juneau, Alaska, by appointment, but Class C is still available throughout K7. In addition to this, Class A and Class B examinations continue available in Alaska by arrangement with any Army Signal Corps station, and at other points through Coast Guard officers.

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THE INTER-AMERICAN ARRANGEMENT

There is a rumor going the rounds that Mexico has repudiated the inter-American radio treaty of Habana and that there will be a serious amateur interference situation as a result. The rumor is unfounded. Mexico on October 28th did reject the North American *broadcasting* arrangement but on that same date did approve the Habana Convention and the Inter-American Arrangement Concerning Radio Communications. The latter is the important administrative agreement assigning amateur bands exclusively to amateurs and subdividing them in agreed manner between 'phone and c.w. as reported in last February's *QST*. Thus Mexico, rather than creating an interference situation, has gone the whole way in the support of amateur radio. Incidentally, the other countries that have so far approved the Habana arrangement are the United States, Chile, Haiti and Peru.

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THE CENTRAL DIVISION MATTER

A young tempest has been kicked up in the Central Division by some members who have not understood the reasons for the outcome of the nominations for director this year. There are murmurings of an "unholy alliance" between the incumbent director, Mr. Mathews, and the Executive Committee, with the latter invoking petty technicalities to keep the former improperly in office. The matter seems to need some further discussion.

First off, we call attention to a letter from Director Mathews appearing in this month's "Correspondence." In 1937 the Board of Directors adopted new rules for the eligibility of candidates for directors, included in which was the requirement that all candidates must have been continuously both a licensed amateur operator and a member of the League for at least four years immediately preceding nomination. The Executive Committee received petitions for six nominees: W8JK, W9UZ, W9ZN, W9BAZ, W9BJE, W9PNV. W8JK and W9ZN withdrew their names by written communication. The petition for V9PNV carried the signatures of only nine League members and so could not be regarded—at least ten are required. Neither W9UZ nor W9BAZ satisfied the requirement of four years uninterrupted membership preceding nomination. W9BJE had neither continuous operator license nor continuous League membership for the four years preceding nomination. These rules are adopted by the Board for the control of the Executive Committee and are binding upon the latter. There was simply no candidate eligible under the rules and so there was no election.

The question now is what happens under such circumstances. The answer is that another rule, By-Law 21, comes into play: it provides that directors are elected for a term of two years or until their successors are duly elected and qualified. The division having failed to name a candidate eligible under the rules, the incumbent director automatically remains in office. This is a customary rule in all such organizations as ours, and in our case has for its purpose preventing the division from losing its vote and its representation through failure to name an eligible candidate. It is true that Mr. Mathews was not a candidate, having withdrawn his name, and it is also true that he would not have been eligible under the present rules to stand as a candidate for re-election. But he was eligible when elected, the rules having been changed since, and his automatic retention in office is not only legal but the only possible outcome of the unusual circumstances. The Executive Committee of course would be open to the gravest criticism if it accepted candidates who were ineligible under the rules. There is reason to feel that the rules themselves may be too severe when they disqualify this many otherwise desirable candidates. With-

out doubt that question will be studied carefully by the Board at its next meeting.

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FINANCIAL STATEMENT

THE third quarter of the League's operations for 1938 showed increasing gross revenues but naturally continuing expenses, resulting in another substantial operating loss before appropriations. Net result is that the League enters the last quarter of the year about even. It is expected that the last quarter, which sees the appearance of the new Handbook, will yield a substantial gain. Third-quarter figures:

STATEMENT OF REVENUES AND EXPENSES, EXCLUSIVE OF EXPENDITURES CHARGED TO APPROPRIATIONS, FOR THE THREE MONTHS ENDED SEPTEMBER 30, 1938

REVENUES		
Membership dues	$12,220.38	
Advertising sales, *QST*	21,548.35	
Advertising sales, booklets	510.00	
Newsdealer sales, *QST*	10,563.98	
Handbook sales	4,618.94	
Spanish edition Handbook revenues	21.43	
Booklet sales	1,834.62	
Calculator sales	232.19	
Membership supplies sales	1,541.39	
Interest earned	569.53	
Cash discounts received	207.41	
Bad debts recovered	39.32	$53,907.54
Deduct:		
Returns and allowances	$3,996.58	
Exchange and collection charges	15.01	
Cash discounts allowed	345.85	
	$4,357.44	
Less decrease in reserve for newsdealer returns of *QST*	26.61	4,330.83
Net Revenues		$49,576.71
EXPENSES		
Publication expenses, *QST*	$15,948.07	
Publication expenses, Handbook	3,662.59	
Publication expenses, booklets	833.16	
Publication expenses, calculators	118.64	
Salaries	24,493.82	
Membership supplies expenses	920.76	
Postage	1,746.03	
Office supplies and printing	1,058.02	
Travel expenses, business	699.70	
Travel expenses, contact	1,747.62	
QST forwarding expenses	987.53	
Telephone and telegraph	627.70	
General expenses	1,322.58	
Insurance	208.32	
Rent, light and heat	1,121.47	
General Counsel expenses	255.25	
Communications Dept. field expenses	119.89	
Headquarters station expenses	714.91	
Alterations and repairs expenses	60.00	
Bad debts written off	67.00	
Provision for depreciation of:		
Furniture and equipment	419.97	
Headquarters station	35.49	
Total Expenses		57,168.52
Net loss before expenditures against appropriations		$7,591.81

New Transmitting Tubes

HK 24

A TUBE in an entirely new size range for transmitting lines is the Gammatron 24. This tube makes use of a tantalum plate with enclosed top to obtain dissipation capability rated at 25 watts.

Maximum height of the tube is 4⅜ inches, and maximum diameter is 1½ inches. The measured height of one tube, exclusive of the plate terminal at top, is 3¾ inches, while the bulb diameter of the same tube measures 1⅜ inches.

Below are given some of the ratings of this tube:

Plate-grid capacity	1.7 μμfd.
Grid-filament capacity	2.5 μμfd.
Plate-filament capacity	0.4 μμfd.

Operation as r.f. power amplifier, Class-C unmodulated:

D.c. plate voltage (max. value)	1500 volts
D.c. plate current (max. value)	75 ma.
D.c. grid voltage	−120 volts
D.c. grid current	20 ma.
Peak r.f. grid voltage	240 volts
Grid driving power	3.8 watts
Power output	89 watts

For operation as Class-C r.f. amplifier with 100-per cent plate modulation, the plate supply voltage is reduced to 1250 and the plate current is reduced to 60 ma. The tubes are rated at 125 watts output in Class-B audio operation.

The maximum ratings for the 24 apply for frequencies up to 60 megacycles; a slight reduction is necessary for 112-Mc. operation, and data on the performance of the tube at frequencies up to 360 Mc. are given by the manufacturer.

810

A new carbon-plate tube suited for operation at 500 watts input as an unmodulated Class-C amplifier, or for 590 watts output (per pair) in Class-B audio operation, is the RCA 810. This tube, including end shields for the filament in a design for more efficient operation at low voltage (2000 volts maximum), makes possible compact construction of high power transmitters for 375 or 750 watts output using one or two of the new tubes. The maximum ratings of the tube are for frequencies as high as 30 megacycles.

(*Continued on page 59*)

One-Half Cubic

A Complete Low-Power

One small chassis contains power supply, speech amplifier and modulator, three r.f. stages — ending in an 807 — and an antenna tuner. Despite a lot of apparatus, the set is an exceptionally clean-looking job.

FIRST and foremost, a frank admission is in order: The outfit to be described is not the result of a pre-formulated plan. Its size and shape were determined at the outset by a sheet of aluminum which I had on hand. The rig arrived at its present state in two distinct stages, beginning as a 160-meter 'phone portable without benefit of buffer. It was built rather hurriedly for a vacation trip, and was much in use in New England this past summer. All in all, the results were satisfactory. The 'phone quality was good and DX contacts of a few hundred miles were not uncommon, but it seemed that at every turn some person of non-ham status would ask me, "How far can you talk on your radio sending set?"

Now, to a ham with nothing but 160-meter coils in his duffle bag, that's just plain embarrassing. My attempts at explaining the higher frequency bands were all but futile; the fact remains that we amateurs have the reputation of talking around the world. No amount of mumbling about "skip distance," 10-meter DX, and the like would satisfy them—or me either for that matter—because, quite naturally, I had talked myself into 20 and 10 meters for the small rig. The job is done, and the methods and results are to be described for what they may be worth.

Oscillator and Harmonic Generator

In the circuit diagram of Fig. 1, a 6F6 (metal tubes are a necessity to conserve space) is used in a conventional pentode crystal oscillator circuit. The feed-back capacitator, C_4, was found necessary when quadrupling to 10 meters in the harmonic generator.[1] The oscillator must be tuned quite near its peak (the oscillator is responsible for a large share of the excitation at the control grid of the final amplifier in this circuit) and therefore cleaner keying resulted from the use of a slight amount of regeneration. The cathode of the oscillator is keyed for break-in. If the oscillator circuit of Fig. 1 is used, the 6F6 shield is grounded at the socket. If the Reinartz circuit is substituted, the shield should be tied to the cathode end of the coil and condenser. Only a 160- and a 40-meter crystal are required for operation in the five lowest frequency amateur bands.

Another 6F6 is utilized in the second stage of the harmonic generator, and is used only when doubling to 20 or quadrupling to 10 meters from a 40-meter crystal. On 160, 80 and 40 meters the Class-C amplifier is driven by the crystal oscillator. The 807 doubles to 80 meters for c.w. operation only at present. If 75-meter 'phone is contemplated, or if the last possible watt of output is desired, a special coil form should be made for L_1 and L_2 and the second stage switched in. It is suggested that this extra long form be made of a length of 1½-inch diameter bakelite tubing fastened to a tube base. The coil sizes and spacing are included in the list. When driving straight through, the second 6F6 should be removed from its socket, although the circuit will function with it in place. SW_1 is a very small homemade knife switch with a victron base, and appears between the oscillator tuning condenser and the power supply chokes in the under-chassis view. It is necessary to omit cathode bias in the second stage and to operate the screen grid at the voltage indicated (a round figure of 200 volts is used at all screens for convenience) for best results.

[1] J. L. Reinartz, *QST*, July, 1937, and April, 1938.

On the New England trip mentioned in the article, Mr. Rice found time to drop in on us at Headquarters last summer, and the gang was greatly impressed by the neat portable job he was carrying around with him. Naturally we inquired as to the possibility of getting a story on it, and here is the result. We think you'll like the outfit as well as we did.

Foot of Transmitter

Phone-C.W. Rig for Five Bands

BY H. E. RICE, JR.,* W9YZH/4

The Final Amplifier

The final amplifier is strictly conventional with the one exception of the connection of screen by-pass C_{12}. SW_2, the 'phone-c.w. switch, cuts in a screen dropping resistor for 'phone operation, and in the c.w. position it does about everything possible to make the most of the available voltage consistent with a clean keyed signal.

Audio

The speech amplifier and modulator are also conventional, and have proved satisfactory. The audio system is, in fact, practically identical to the Class-B amplifier for portable use described in the current RCA "Receiving Tube Manual." A double-button carbon microphone is used.

Antenna Coupler

The antenna coil consists of 36 turns of No. 18 bare copper wire, 1¾ inches diameter, winding length 2¾ inches, with spring brass slider clips at either end, one to vary the tap and thereby the coupling to the final tank and the other to short out turns from the voltage end. Suffice to say that with the 360-μμfd. condenser connected across the coil the resultant tank circuit will tune to 160, 80 and 40 meters.

Power Supplies

The main power supply uses an 83 rectifier and delivers 300 volts under full load. SW_3 is the send-receive switch.

It is granted that a separate bias supply for a transmitter of this power may, at first glance, seem out of place. In this instance, cathode biasing of the 807 meant a sacrifice of precious power, and it is out of the question in the second stage. I prefer to key the oscillator and I don't like soaring plate current whether or not the plate dissipation rating of a tube is exceeded thereby. The pack shown fills the bill nicely, is quite economical and very compact. With the components specified, the plate current of the last two stages falls to zero when the oscillator circuit is opened.

*Great Smoky Mountains National Park, Gatlinburg, Tenn.

COIL DATA

L_1—(a) 1.75-Mc. crystal: 52 turns No. 24 enamel closewound.
(b) 7-Mc. crystal: 14 turns No. 20 d.c.c. closewound.

L_2—(c) 3.5 Mc.: 26 turns No. 20 d.c.c. closewound.
(d) 14 Mc.: 7 turns No. 18 enamel, length ½ inch.
(e) 28 Mc.: 3½ turns No. 18 enamel, length ½ inch. (This coil, with a 25-μμfd. condenser, will hit only the 4th harmonic.)

When doubling or quadrupling, coils L_1 and L_2 are wound on the same coil form, spaced as follows: a-c, 2½ inches; b-d, 1 inch; and b-e, ½ inch. All L_1 and L_2 coils are 1½ inches diameter. For output on 1.75 and 7 Mc., separate coils are used at L_1, i.e. coils with no other winding on the form. The two coils needed for 1.75-Mc. output are shown in one of the photographs. Ten-meter coils are in the sockets.

L_3—1.7 Mc.: 44 turns No. 20 d.c.c. closewound on 1¾" dia. form.
3.5 Mc.: 26 turns No. 20 d.c.c. closewound on 1¾" dia. form.
7 Mc.: 40-meter end link Decker coil, 2 turns removed.
14 Mc.: 20-meter end link Decker coil, 2 turns removed.
28 Mc.: 10-meter end link Decker coil, 3 turns removed.

Construction

The chassis measures 10 by 12 inches and is 2½ inches deep. It is made of 1/16-inch half-tempered aluminum, and is equipped with rubber mounting feet at the four corners. The layout of parts is controlled by the chassis, and unless a slightly larger size is used, would have to be followed quite closely if the performance is to be duplicated.

Beginning at the right rear corner, the power transformer is mounted under the chassis with the cover plate on top. This is believed to be the simplest and neatest method of mounting this

This is the complete transmitting layout, ready to be hooked to an antenna and the 110-volt power source. The microphone input circuit, in the aluminum box at the right, contains the mike battery, transformer, and microphone-current control; it could be incorporated in the main unit by making the chassis a little larger. With two crystals, the set can be operated on all bands from 1.75 to 28 Mc.

type transformer in all cases since the cut-out edges are hidden and thus do not need to be smooth. The electromagnetic properties are in no way impaired.

The antenna tuning condenser is mounted vertically on small standoffs just to the left of the power transformer, with the coil form suspended from it by aluminum brackets. A National ceramic form, 1¾ inches diameter by 3½ inches long, was found suitable for this purpose and is fastened permanently in place. Next in line along the rear is the rectifier tube, with the modulation transformer at the corner. The 6N7 modulator, driver transformer, 6N7 driver, and 6C5 speech amplifier at the left front corner follow in that order in a staggered row along the left-hand edge. The crystal pilot-bulb current indicator, oscillator tube, and oscillator and harmonic generator coil form with C_2 of Fig. 1 mounted inside are grouped in a shield compartment to the right of the 6C5. The right front corner of this shield is folded to the right three quarters of an inch, and serves as a support for a panel bushing to guide the insulating rod which turns the antenna condenser. The socket for the harmonic generator tube is located just outside the shield, with its center 1¼ inches from the front and 5 inches from the right-hand edge of the chassis. It was necessary to crowd this socket as far to the left as possible to leave room behind the chassis front for the two d.p.d.t. toggle switches. The center of the socket for the 807 is 3½ inches from the front and 3½ inches from the right-hand edge. The final tank coil socket is to the right and to the rear of the 807, with the condenser at the right front corner.

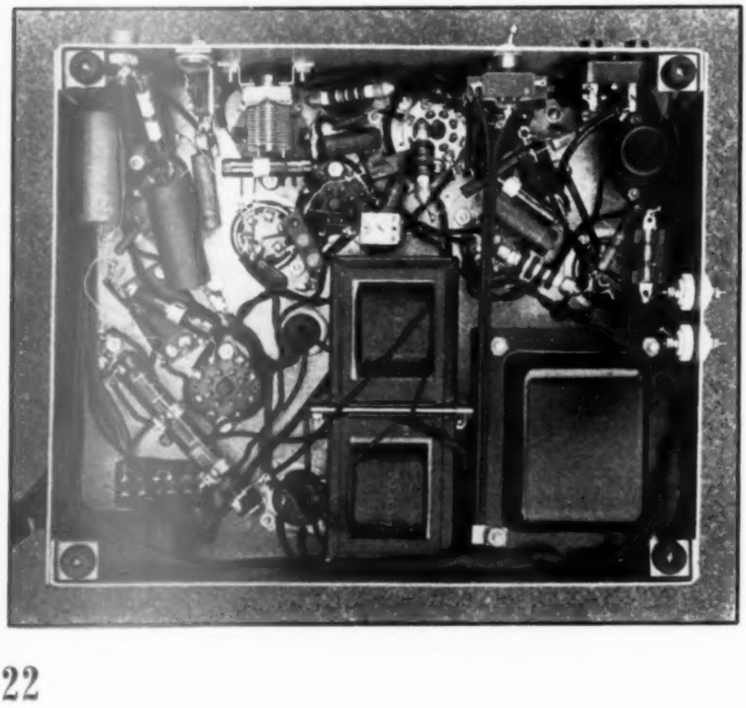
The power supply chokes are mounted end to end on an aluminum bracket under the chassis. The main filter condenser is bolted through in the usual way directly behind the oscillator shield compartment. The bias pack with its rectifier tube is under the chassis ahead of the transformer. C_1 is also underneath, and tunes with a screwdriver from the front. It will be noted that the screwdriver hole is fitted with a rubber grommet to prevent accidental short circuits. Lock washers are used throughout, and all variable condensers are set reasonably tight.

The microphone input with its battery is in a separate aluminum box 4 by 4½ by 6 inches, the bottom of which extends out from the left side to form a weighted base to which the straight key is bolted. A length of crystal microphone cable connects from R_6 to the grid of the 6C5. These details can be seen in the photograph. The microphone input, complete as shown, was on hand at this station. It would be entirely practicable to mount the transformer under the transmitter chassis, in which case the voltage should be taken from the power pack, and the gain might well be fixed for the normal input to the modulated amplifier.

Operation

No hum troubles were encountered, so it was not found necessary to connect the chassis to an earth ground. In the event of an accidental short circuit to ground, the 1/32-ampere fuse in the bias supply will prevent possible damage to the rectifier tube from a grounded power line.

Parasitic chokes were found necessary on 20 and



Most of the below-chassis space has been utilized, as this below-chassis view shows. Note the 6H6 bias rectifier in the upper right-hand corner. The chassis is bent from a sheet of semi-hard aluminum.

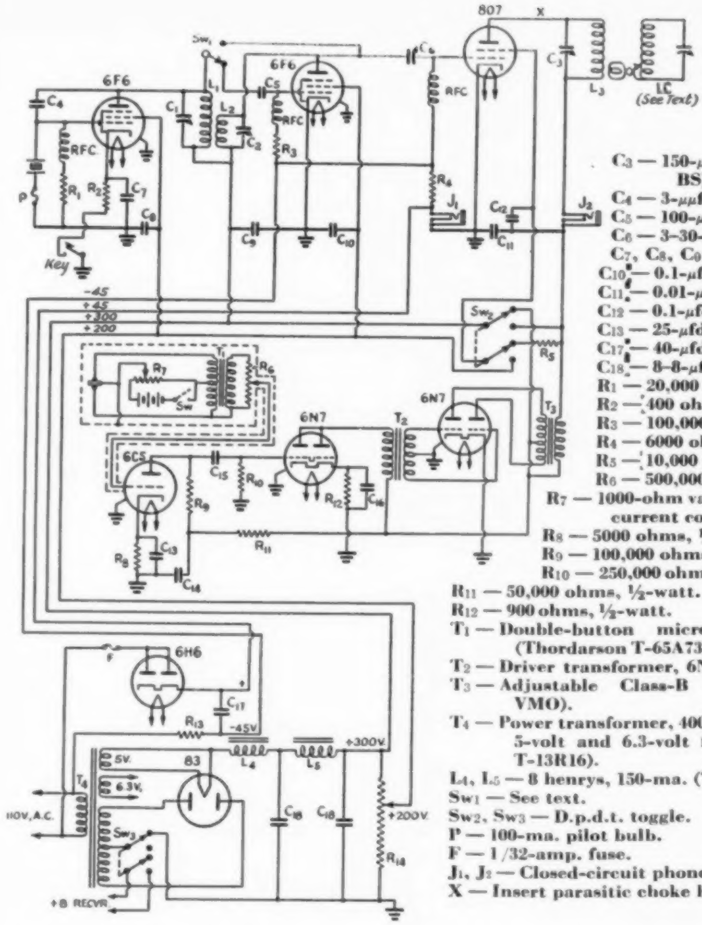


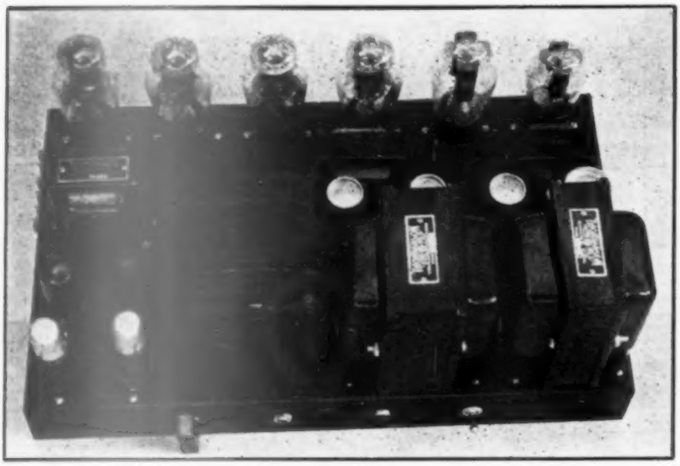
Fig. 1 — Circuit diagram of the complete transmitter.

C_1 — 140-μμfd. variable (Hammarlund APC-140).
C_2 — 14 Mc., 50-μμfd. variable (Hammarlund APC-50).
28 Mc., 25-μμfd. variable (Hammarlund APC-25).
C_3 — 150-μμfd. variable (Cardwell MR-150-BS).
C_4 — 3-μμfd. maximum.
C_5 — 100-μμfd. maximum.
C_6 — 3-30-μμfd. trimmer (National M-30).
C_7, C_8, C_9 — 0.01-μfd. mica.
C_{10} — 0.1-μfd. paper. C_{14} — 0.5-μfd. paper.
C_{11} — 0.01-μfd. mica. C_{15} — 0.02-μfd. paper.
C_{12} — 0.1-μfd. paper. C_{16} — 25-μfd. electrol.
C_{13} — 25-μfd. electrolytic.
C_{17} — 40-μfd., 150-volt electrolytic.
C_{18} — 8-8-μfd., 600-volt electrolytic.
R_1 — 20,000 ohms, ½-watt.
R_2 — 400 ohms, 2-watt.
R_3 — 100,000 ohms, ½-watt.
R_4 — 6000 ohms, 1-watt.
R_5 — 10,000 ohms, 10-watt.
R_6 — 500,000-ohm gain control.
R_7 — 1000-ohm variable, with switch (microphone current control).
R_8 — 5000 ohms, ½-watt.
R_9 — 100,000 ohms, ½-watt.
R_{10} — 250,000 ohms, ½-watt.
R_{11} — 50,000 ohms, ½-watt. R_{13} — 4000 ohms, 1-watt.
R_{12} — 900 ohms, ½-watt. R_{14} — 20,000 ohms, 30-watt.
T_1 — Double-button microphone to grid transformer (Thordarson T-65A73).
T_2 — Driver transformer, 6N7-6N7 (Thordarson T-67D47).
T_3 — Adjustable Class-B output transformer (U.T.C. VMO).
T_4 — Power transformer, 400 v. each side c.t. at 200 ma., with 5-volt and 6.3-volt filament windings (Thordarson T-13R16).
L_4, L_5 — 8 henrys, 150-ma. (Thordarson T-13C30).
Sw_1 — See text.
Sw_2, Sw_3 — D.p.d.t. toggle.
P — 100-ma. pilot bulb.
F — 1/32-amp. fuse.
J_1, J_2 — Closed-circuit phone tip jacks (see text).
X — Insert parasitic choke here (see text).

10 meters. Ten turns of No. 18 enameled wire, ¼ inch diameter (wound on a test prod) cleared the circuit. The choke was wired in by soldering directly to the 807 plate clip.

Provision for metering is accomplished by the use of shorting type 'phone-tip jacks in the grid and plate circuits of the final amplifier. A test meter is used for this purpose. The antenna coupling is adjusted to draw 65 plate milliamperes for 'phone operation and 85 for c.w. Thus the input varies between 16 and 25 watts. With bias and plate voltage applied, there is enough excitation at the control grid of the 807 to cause 6 to 7 grid milliamperes to flow through 6000 ohms at 10 meters and 10 or more on the lower frequencies. Be that as it may, it is important that excitation be controlled. There is a very definite optimum for each plate current reading for linear operation and greatest output. Between 3½ and 4 milliamperes will be about right. The plate tank of the second 6F6 may be detuned when necessary. However, in most instances, satisfactory control of excitation can be maintained by detuning the oscillator, which practice lowers the crystal current and improves the keyed signal.

This transmitter is one solution of a completely self-contained rig, for use away from the home station, in which nothing but power is sacrificed. It has been of very real interest as a proving ground for the harmonic generator operated at a low plate voltage and for the small bias pack. A socket could be wired in readily to provide for convenient connection to an independent power source for field use. My 300-watt transmitter is very much on the shelf for the present.



The wide-range 30-watt amplifier complete with power supply. The gain control knob is at the left on the front of the chassis, with microphone jack, pilot light (2.5-volt light in parallel with the 2A3 filaments), and power switch in order toward the right. The two 6J7 tubes are at the left front corner of chassis, with the two 6N7 tubes directly behind. The output transformer is located at the front center of chassis, with power transformer to the right and 250-ma. choke at the right front corner. The four condenser cans are in a row behind the transformers and large choke, and the two small chokes are directly behind the condensers. The input transformer for the 2A3 tubes is directly behind the 6N7 tubes.

A Wide-Range Audio Amplifier

All-Push-Pull Stages Applied to 30-Watt Amplifier-Driver

BY T. M. FERRILL, JR.,* W1LJI

If all of the different phases of interest in amateur radiophone work were averaged, it would probably be found that the first interest of the operators in their equipment is quality and fidelity, with power, flexibility, and general utility following closely in some such order as that given. It should be realized, however, that neither an extremely wide frequency response range nor extremely low percentage distortion is necessary for an amateur 'phone station of excellent voice quality. A frequency range with less than 2 db variation between 100 and 4000 cycles is adequate for this purpose. The usual broadcast program has a range of the order of 100 to 5000 cycles, and experience indicates that a frequency range of 80 to 8000 cycles is adequate to give excellent reproduction of all sounds except certain types of noises.[1] Amplitude distortions of 3 to 5 percent are detectable but are not considered objectionable, while 10-percent distortion is quite noticeable.

What characteristics, then, should a 'phone operator "go after" when building a high-quality transmitter? If any of the audio equipment is to be used for other services, such as public address or theatre amplifier work, it would be desirable to include a range of 60 to 15,000 cycles, making possible substantially perfect reproduction of music as well as speech.[1] In modulation of an amateur 'phone transmitter, however, such a broad range is not only unneeded, but also *very undesirable.* The high-frequency portion of this range would add little to the naturalness of the speech if reproduced in the receiver, and a superheterodyne with sufficient selectivity for satisfactory reception in the crowded 'phone bands loses this high-frequency part of the transmitted speech. Reference to a typical receiver selectivity curve[2] shows that even if the transmitter has absolutely no frequency discrimination in the audible range of frequencies, the audio output of the second detector in the receiver will be approximately 25 db lower at 5000 cycles than at 100 to 500 cycles and approximately 50 db lower at 10,000 cycles, so that there is nothing to be gained by transmitting the audio frequencies above 5000 cycles. More important for amateur communication work is the fact that the *high frequencies not received by the station contacted may interfere with reception of the stations 10 to 15 kilocycles from the frequency of the transmitter.*

The amplifier shown and described here is intended not as a compromise between a narrow-range system and one suited for purposes other than amateur 'phone work, but as an excellent amplifier for any audio-frequency application. As shown in Fig. 2 it is provided with a condenser (C_8) which limits the high-frequency response of the system, with the resulting curve shown in dashed line in Fig. 1. This curve coincides with

* Technical Dept., *QST.*

[1] F. E. Terman, *Fundamentals of Radio*, page 432, McGraw-Hill Book Co., Inc., 1938.

[2] Page 97, *The Radio Amateur's Handbook*, 16th Edition, 1939.

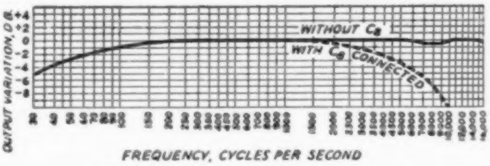


Fig. 1 — Frequency response curves taken with limiting condenser connected for voice transmission and omitted for other uses.

the response curve of the amplifier without condenser up to above 1000 cycles, and then gradually begins falling off, being noticeably low past 5000 cycles. At 10,000 cycles the response has decreased more than 10 db, and this, coupled with the fact that the amount of energy in this frequency region produced by the voice is very small, makes for almost complete elimination of interference from broad side-bands sometimes mistakenly attributed to overmodulation in the case of high-power transmitters.

If operation of the amplifier as a wide-range unit is desired, it is only necessary to disconnect C_8, so that the extremely wide response range shown in solid line in Fig. 1 is the result. Actually, the amplifier is built for this range, and the condenser is an accessory for 'phone operation.

There are several factors which take part in determining the frequency range of an amplifier. If the cathode bias resistor of a single-tube amplifier is by-passed by a too-small capacitance, the low-frequency response of the stage will be impaired, particularly if the cathode resistor is small and the amplification is high. Either a large capacity at this point or a bias cell used in the grid circuit of the stage with the cathode grounded, is a simple remedy at this point. A capacitance of 20 to 50 microfarads is usually sufficient for good low-frequency response if a cathode resistor of 2000 ohms or less is used, and smaller capacities are suitable for larger resistors.

Another factor often found to be the cause of poor low-frequency response is insufficient primary inductance of audio coupling transformers, particularly those used to couple power amplifier stages. Better transformers are at least a partial solution to this difficulty, but sometimes this solution is too expensive to be justified.

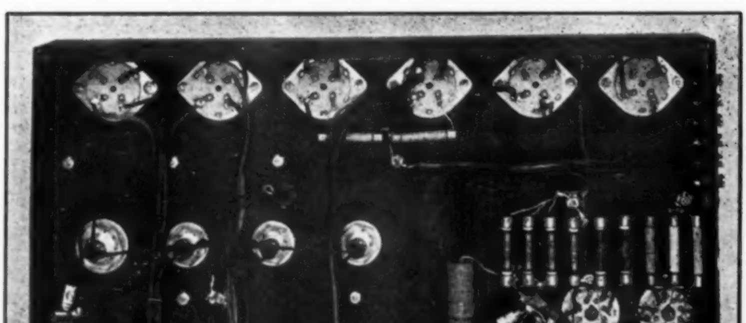
Coupling condensers used between voltage amplifier stages must be included in the list of items which might impair the low-frequency response of the amplifier, but tubular paper condensers rated at 600 volts and at 0.01 to 0.1 μfd. are entirely satisfactory.

Causes for loss of high-frequency response in audio amplifiers include decrease of effective plate load impedance of one stage by high effective input capacity of a following stage (most noticeable with high-mu triode types having high plate-to-grid capacity) and decrease of effective plate load impedance of a voltage amplifier stage by high capacity of the plate transformer windings. If the first of these two troubles is experienced, it may be reduced by use of either a lower-mu triode or lower values of plate and grid coupling resistance. If the latter is the offender, a better (and usually more expensive) transformer is the direct solution.

Since it is possible to replace range-limiting condensers with larger capacitances at very little cost relative to the resulting improvement of the frequency range, there is a strong tendency in the design of amplifiers toward use of resistance coupling of voltage amplifier stages in preference to transformer coupling.

A means of improving the frequency range of an amplifier is the introduction of inverse feedback in one stage, or over two or three; this requires provision for more gain than would otherwise be necessary, and requires additional apparatus, although the result usually gives more than justification for the expense and work neces-

Note that the power supply components and wiring are confined to the half of the chassis at left in this view. The input condensers and chokes are located at the microphone jack, and from the ends of the chokes, shielded wires go through the chassis to the grids of the 6J7 tubes. Plate and grid coupling condensers for the voltage amplifier stages are mounted in a compact group behind the 6N7 tubes. The whole layout is planned for simplicity, with placement of parts for the output of one stage to feed right into the input of the next. In the row of 4-prong tubes, first is the 82, second is the 83, and then four 2A3's.



sary. Inverse feed-back also tends to reduce the hum and the amplitude distortion in the stages over which it operates.

The amplifier described in these pages is entirely orthodox in all features except one — the use of push-pull stages throughout. As will be seen from the solid line of Fig. 1, inverse feed-back is not needed for extension of the range of this amplifier, since the response at the low- and high-frequency ends of the desirable range is quite high.

This excellent frequency characteristic is made possible primarily by use of push-pull stages throughout so that the current through the bias resistors is almost constant over the audio cycle, and thus the use of cathode by-pass condensers which might cause frequency discrimination is made unnecessary. Use of resistance-coupled voltage amplifier stages with sufficient coupling-condenser capacity and with coupling resistors chosen with due regard to the high-mu triodes is a further step toward wide-range response. Since the output stage in an amplifier of this power is almost invariably push-pull, and since a push-pull stage is usually considered a desirable driver for the output amplifier (particularly with such an output stage as four small triodes which are likely to have some grid-current flow on audio peaks), the use of push-pull stages from the input of the amplifier simplifies the problem of driving the output stages without a transformer.

Whereas addition of inverse feed-back to an amplifier makes a marked decrease in hum level, the push-pull stages throughout this amplifier perform this function also,[3] to a very marked ex-

[3] Ferrill, "Refinements in Combination Exciters," *QST* Oct., 1938.

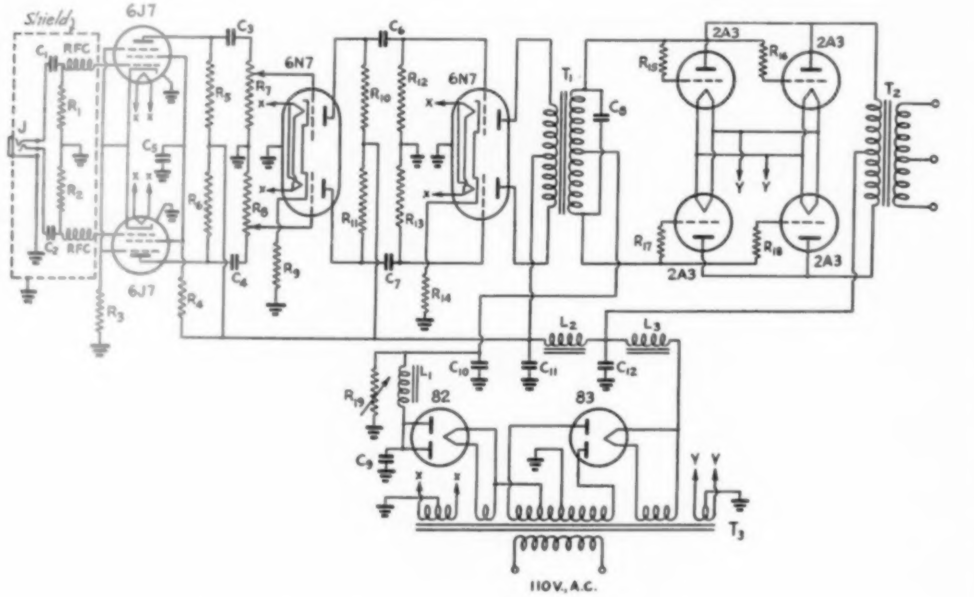


Fig. 2 — Circuit diagram of the amplifier with range limiter

C_1, C_2 — 0.006-μfd. mica, 600-volt.
C_3, C_4, C_6, C_7 — 0.01-μfd. paper tubular, 600-volt.
C_5 — 0.1-μfd. paper tubular, 600-volt.
C_8 — 0.002-μfd. mica, 600-volt.
C_9, C_{10} — 8-μfd. sections of dual electrolytic, 250-volt working (Mallory RM252), positive leads grounded, negative leads connected to ends of L_1.
C_{11} — 16-μfd. electrolytic, 500-volt working (two Mallory HD683 connected in parallel).
C_{12} — 8-μfd. electrolytic, 500-volt working (Mallory HD683).
J — 3-wire jack.
R_1, R_2 — 2-megohm, ½-watt carbon.
R_3 — 600-ohm, ½-watt carbon.
R_4 — 0.6-megohm, 1-watt carbon.
R_5, R_6, R_{10}, R_{11} — 0.25-megohm, 1-watt carbon.
R_7, R_8 — 2-gang, 500,000-ohm potentiometer (Centralab 4-010804).
R_9 — 2000-ohm, 1-watt carbon.
R_{12}, R_{13} — 0.5-megohm, 1-watt carbon.
R_{14} — 700-ohm, 1-watt carbon.
R_{15}, R_{16}, R_{17}, R_{18} — 100-ohm, 1-watt carbon.
R_{19} — 2,500-ohm, 25-watt, semi-variable (see text).
T_1 — Push-pull driver input transformer (Thordarson 74D32).
T_2 — Multi-match driver transformer (Thordarson 15D80).
T_3 — Power transformer to deliver a.c. voltages as follows: 435 volts each side of center-tap at 250-ma. d.c. load; 80 volts (single tap) for bias rectifier; 2.5 volts, center-tapped, at 10 amperes; 2.5 volts at 3 amperes, 5 volts at 3 amperes, 6.3 volts, center-tapped, at 1.5 amperes (Thordarson 75R50).
L_1 — 7.2-henry, 120-ma. choke (Thordarson 75C49).
L_2 — 22-henry, 35-ma. choke (Thordarson 18C92).
L_3 — 13-henry, 250-ma. choke (Thordarson 75C51).
RFC — 2.5-millihenry, 125-ma. r.f. chokes.

tent when hum in the amplifier would arise from a slight a.c. content in the power supply output voltage.

Since the non-uniformity of 2A3 tubes has been the subject of some comment[4] in discussions of push-pull power amplifiers, readers may desire an explanation of the reason for use of these tubes in an amplifier designed for better-than-ordinary performance. To meet this demand, measurements were conducted on a small assortment of 2A3 tubes of different makes and ages. Although much variation was noted in the static plate currents of different tubes at maintained grid and plate voltages throughout the operating range of the tubes, it was found that the *change* in plate current with a definite *change* in grid voltage was quite uniform for the assortment of tubes tested. Since the second-harmonic distortion produced in a push-pull amplifier of transformer output is dependent on the non-uniformity of dynamic characteristics of the tubes rather than on differences of static characteristics, the second-harmonic distortion generated in the output stage as a result of non-uniformity of the tubes will be smaller than the distortion contributed by other causes, and thus may be neglected in the choice of tubes.

Construction

The amplifier is built on a steel chassis measuring 17 by 10 by 2 inches. The arrangement of parts is planned for short, direct wiring, more for convenience than for reasons associated with the operation of the amplifier. The only precautions necessary in the wiring are that the input wiring (from microphone jack to grids of 6J7 tubes) be shielded, and that the a.c. leads be kept away from the circuits of the first two stages.

R.f. chokes are used to isolate the input of the 6J7 stage from radio frequency pickup in the microphone cable, which latter should be of the two-wire shielded type. The shielding braid of the cable and the shell of the microphone are grounded, and the two wire conductors of the cable are connected to the crystal element of the microphone (or to the high-impedance transformer winding in a velocity type). Resistors R_1 and R_2 shown in the circuit diagram of Fig. 2 serve as a voltage divider as well as a d.c. connection between grids and ground, so that only two wires are necessary to connect the output of the microphone to the amplifier input.

The two-section gain control, R_7 and R_8, is provided with two complete separate elements operated by a single shaft, and has three connection lugs on each element. These lugs should be connected as pairs; the pair at the counter-clockwise ends of the resistance strips (viewing the control from the front panel) should be connected to ground, the pair of middle lugs should be connected to the grids of the first 6N7 amplifier, and the pair at the clockwise ends of the strips should be connected to the 6J7 coupling condensers.

The output transformer is provided with taps (only two connections are made to two jacks at bottom of the transformer) connected to jacks on an outside terminal board. Impedances corresponding to turns ratios of 1: 1, 1: 1.25, 1: 1.5., 1: 1.75, and 1: 2 are made readily available for matching almost any desired pair of Class-B modulator grids. By means of a terminal strip at the side of the chassis, two wires may be run directly to the grids of the Class-B amplifier, while a third wire (from terminal connected to the transformer secondary center-tap) may be used for application of fixed bias to the modulator grids, or may be grounded for zero-bias Class-B tubes. The fourth and fifth terminals on the strip are used as 110-volt a.c. terminals, to facilitate use of the amplifier for various purposes and to suit it to connection of power cables in a transmitter installation.

The 2,500-ohm semi-variable resistor provides for adjustment to −62 volts of the bias voltage applied to the 2A3 grids. In the amplifier shown here, this voltage was obtained with the tap on the resistor set for the full 2500 ohms. This would suggest the use of a resistor of 3000 ohms which might well be obtained at the beginning of construction of the amplifier, so that there is no danger of finding the available range of bias voltage too small. If no voltmeter suitable for measuring the bias voltage is available, the slider tap on this resistor should be set for a no-signal plate current of 40 ma. per tube. With the bias resistor setting determined, a plate milliammeter may be inserted in series with each 2A3 plate (the other three plates should be connected directly to the ends of the transformer primary winding during each measurement) and the no-signal plate currents of the four tubes at this bias may be determined. If it is found that one parallel pair of 2A3 tubes is carrying much higher current than the other pair, the tubes may be interchanged until the total currents to the two pairs are approximately equal. This is not a particularly important operation, however, as the previous remarks regarding unbalance of the tubes indicate, and is only suggested as a step to satisfy the most exacting builder.

[4] Brown and Hawkins, "Low Z for Linearity," *QST*, Oct., 1938.

Strays

W8QBW writes that it has been called to his attention that a flashlight-lamp antenna current indicator (*QST*, October, 1938) may be the cause of a chirpy signal when used in conjunction with a self-excited oscillator feeding the antenna. Comparatively few of these are in use nowadays, but it's a point worth remembering if a bulb should be used with one of them. It's not likely to occur with a crystal oscillator or m.o.p.a.

'Phone "Splatter"

Not all Broad 'Phone Signals Result from Overmodulation

BY DOUGLAS FORTUNE,* W9UVC

Those crackles extending out beyond the normal side-bands accompanying voice transmission may be caused by overmodulation — and again, they may not. So don't be too sure that your 'phone is "sharp" when the oscilloscope says the modulation peaks are staying below the 100 per cent mark. How come? Well, read what W9UVC has to say about a prevalent, but overlooked, cause of 'phone "splatter."

At the present time there is a great deal of discussion concerning the broad signals so prevalent in our 'phone bands. It is a fair estimate to say that 95 per cent of all 'phone stations occupy more space in the band than they should, in spite of the fact that some operators conscientiously try to reduce the band width by limiting the frequency response of their speech amplifiers. Although this measure does help matters, the "splattering" still continues. This condition, although generally attributed to overmodulation, may be due to a number of causes. In reality overmodulation, by the very nature of the design of the average amateur transmitter, is often an impossibility.

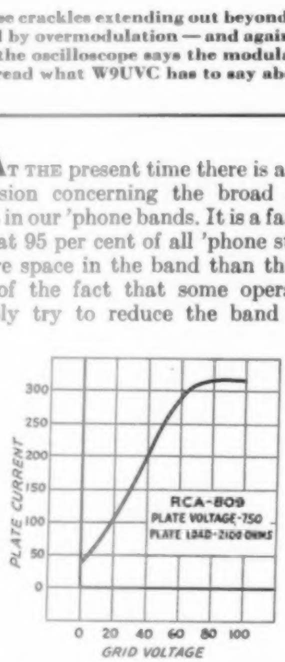


Fig. 1 — Dynamic grid-voltage plate-current characteristic of the 809 tube, used by the author as an illustration.

"Splattering" is the result of any condition which causes the 'phone signal to occupy an exceedingly wide channel. Since the channel occupied is equal to twice the highest audio frequency, any audio distortion in the form of harmonics will tend to broaden the signal. Thus a 'phone transmitter modulated by a 400-cycle sine wave occupies a channel width of 800 cycles. However, if the 400-cycle signal should contain an appreciable amount of third-harmonic distortion, the highest audio frequency would be 1200 cycles and the band width 2400 cycles. The addition of the third harmonic has thus trebled the band width. For this reason "splattering" is due not only to overmodulation but also to excessive audio distortion, most frequently introduced in an overdriven Class-B modulator or driver stage. A step in the direction of eliminating "splattering" in the bands is through the use of automatic modulation control. This circuit, if operated in conjunction with a properly designed modulator, actually will increase the average side-band power and eliminate excessive audio distortion.

For a given amount of *peak* power, speech operation of a Class-B modulator calls for an *average* plate current of only one-half the sine-wave value as specified by the tube manufacturer. Since the Class-B plate current meter is the usual modulation indicator the amateur, in nine cases out of ten, "kicks up" the average speech plate-current to the sine-wave value. Under these conditions the power represented by the increase in average modulator plate current corresponds to an increase in average power without appreciably increasing the peak power. This in turn corresponds to alteration of the wave shape, or the introduction of distortion in the form of harmonics which broaden the signal.

Average vs. Peak Power

Fig. 1 shows the dynamic characteristics of the RCA 809. It may be seen that the characteristic

* Thordarson Elec. Mfg. Co., Chicago.

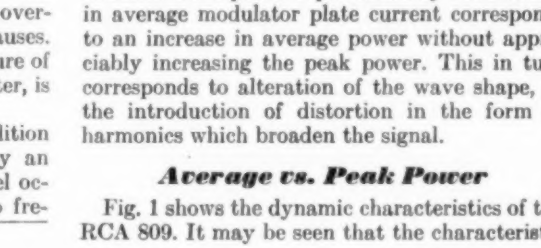


Fig. 2 — Three types of waves having the same peak values but containing different amounts of power. A, the familiar sine wave; B, flat-topped wave typical of an overdriven Class-B stage; C, the extreme case of a square wave.

is fairly straight up to a grid voltage of + 65 volts. However, beyond this point the characteristic bends sharply, with the result that above + 65 volts an input signal of any wave shape will become flat-topped. At this point the grid impedance of the Class-B stage changes abruptly, and further flattening of the wave takes place in the driver stage. It should be noted that beyond + 65 grid volts the peak current (from which peak power is determined) does not change appreciably although the average power, which is proportional to the area of the wave, increases rapidly. This may be seen more clearly from Fig. 2, which shows a sine wave, a flat-topped wave, and a square wave, the peak values of which are equal to E. The average value of each of the waves is different and is equal to the area under the wave divided by the base. It may be seen that as the wave form approaches the square wave the average power increases. Now it must be remembered that in a Class-B modulator the peak power is the limiting factor and the average power falls where it may, depending entirely upon the wave shape. If distortion is to be avoided in speech operation the average power must be equal to only one-quarter the peak value, and as a result the average power of speech, with peak power the limiting factor, is rather low in comparison to the sine wave or the square wave.

For modulation purposes it is important to have as high a value of average power as possible without distorting the wave by causing it to become flat topped. To this end broadcast operators "ride the gain," increasing the gain for weak signals and decreasing it for strong signals. If the gain is not varied but set so that full output power is obtained with the strong signal, the output will be below normal for the weaker signal. By the same token if the gain is set so that full output is obtained from the weak signal, overload and distortion will result on the strong signal. However, if the gain is varied with the signal, the average power is increased without distortion taking place. The same effect of "riding the gain" may be obtained automatically by means of an automatic modulation control circuit which maintains the speech amplifier output constant for any input signal above a certain level. In this manner the amplifier gain is high for low input signals, and it is decreased proportionally for high inputs, thus increasing the *average* power.

It is not the purpose of this article to show the automatic modulation control circuit, which has already been described,[1] but a few words on the operation of such a circuit may be in order. For correct operation, the gain control should be advanced slightly beyond the point for normal operation so that on strong signals the rectifier circuit supplying the bias to the control tube will be brought into operation.

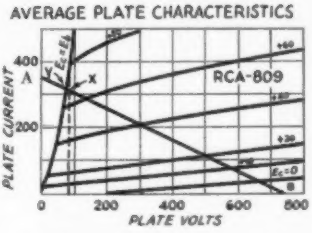


Fig. 3—809 plate-voltage plate-current family, showing load line.

In using automatic modulation control, it is quite possible for the Class-B stage to be overdriven without overmodulation taking place, and as a result the amateur who has incorporated one of these circuits in his transmitter may be unaware of the "splattering" which he is causing. In using the automatic modulation control circuit, it is safe to say that the circuit is not operating properly if the average modulator plate current, on speech, is much greater than one-half the sine wave value. If it is found that this is so, the Class-B plate-to-plate load may be reduced below its original value.

Overmodulation?

The fact that overmodulation is sometimes impossible may be seen from Fig. 3, which shows the familiar plate characteristics of the 809. The normal load line of $\frac{8400}{4}$, or 2100 ohms, is shown at AB. For an average sine-wave power output of 100 watts, the peak plate current is $\sqrt{\frac{200}{2100}}$ or 0.315 ma. at point X on the load line. The peak voltage developed across the load is 0.315×2100 or 660 volts, and the minimum plate voltage is thus 750–660 or 90 volts. The 660 peak volts across one-half the primary are transferred to the secondary of the modulation transformer to vary the effective voltage of the Class-C stage. If by a wild stretch of the imagination the 809 grids were driven sufficiently hard so that the entire voltage of 750 volts were effectively across the load, the transmitter would be modulated only $\frac{750}{660} \times 100$, or 114 per cent. In actual practice the minimum plate voltage would not drop much below the value of peak grid voltage (point Y) and the transmitter would be modulated $\frac{750-65}{660} \times 100$ or 104 per cent, so that even under ideal conditions this would not cause a great deal of "splattering." Poor regulation in either the a.c. line or in the power supply will tend to lower the value of minimum plate voltage. The primary resistance of the output transformer also tends to reduce this value since the voltage lost across the primary must be calculated from the value of peak current, which is usually high even for a medium-power modulator.

The tube manufacturer's Class-B rating is based upon theoretical considerations, and does

(*Continued on page 66*)

[1] Plummer, Waller, "Negative-Peak Automatic Modulation Control for Plate Modulated 'Phone Transmitters," *QST*, October, 1937.

The Cairo Regs Go Into Effect

A Few Changes of Interest to Amateurs, Effective January 1st

BY KENNETH B. WARNER,* W1EH

On the first of the New Year the changes in the international radio regulations adopted at the Cairo Conference go into effect except those relating to frequency allocations, which are not effective until September 1st next — and which have no application to amateur radio in the Americas, anyway. There is nothing very important in these other subjects, but there are a few details that we think will interest the active amateur.

We should perhaps first examine the question of the changes in the code characters for punctuation marks. These are not embodied in the new radio regulations, but originated in the telegraph conference held simultaneously in Cairo and were consented to by the radio conference. A.R.R.L. Hq. is having a great deal of difficulty in ascertaining the extent to which these changes will be adopted in radio procedure on January 1st — nobody seems to know. We know that they take effect on the land lines of Europe; it is probable that the international point-to-point radio circuits will adopt them; but it seems very questionable whether they will be put into effect in American domestic work, particularly in the maritime mobile service which is our closest relation in the commercial services. If the domestic commercial and government services adopt the changes, we of course shall want to also, but there is a general reluctance to change and we doubt its happening. So the dope at the moment is that, at least until further notice in *QST*, we of the A.R.R.L. are *not* adopting these punctuation changes.

An interesting change occurs in the Q code. You are all aware of the confusion in QSA meanings because signal strength and readability have been combined in one indication — the situation that impelled amateurs to the adoption of the RST system. The administrations now take a page from our book by separating these functions, assigning the strength indications to QSA on a 1-to-5 scale and the readability indications similarly to QRK. The following new practice is now established:

Strength

QSA 1 — Barely perceptible
QSA 2 — Weak
QSA 3 — Fairly good
QSA 4 — Good
QSA 5 — Very good

Readability

QRK 1 — Unreadable
QRK 2 — Readable occasionally
QRK 3 — Readable with difficulty
QRK 4 — Readable
QRK 5 — Perfectly readable

'Phone men who have retained the practice of making mumbo-jumbo about "QSA 4, R8," and so on, should find this new nomenclature preferable — if they feel they must use telegraphic abbreviations instead of saying it with words. In voice operating most of us prefer to *talk* about strength and readability, using those terms. For c.w. work, we'll be sticking to RST as preferable. But we thought you'd like to know the new meanings, to understand practice in the commercial mobile service.

Three uninteresting additions have been made on the end of the Q code:

QUK? means, "Can you tell me the condition of the sea observed at . . . (place or coördinates)?", while the accompanying meaning for *QUK* is, "The sea at . . . (place or coördinates) is . . ."

In similar fashion, *QUL?* asks, "Can you tell me the swell observed at . . . (place or coördinates)?", while the companion answer *QUL* means, "The surge at . . . (place or coördinates) is . . ."

QUM? asks, "Is the distress traffic ended?", and *QUM* itself asserts that "The distress traffic is ended."

There is one new two-letter abbreviation, a useful one: *TU* means, "Thank you for the coöperation given." Being shorter, it is now probably preferable to our *TNX* and *TKU*.

Those of you who listen in on the maritime mobile service will be interested to know that, in addition to two forms of CQ, there is now to be a CP call. In amateur radio we use CQ as a general inquiry signal, ending the transmission with a K, but for our broadcasts of general A.R.R.L. information we use the call QST. The mobile service uses the inquiry signal CQ in just the way that we do, but they also use it, omitting the terminal letter K, for their broadcasts of information intended to be used by anyone who can receive it — that is, as a call to all stations without a request for reply. The new call CP is a restricted version of the latter use and is designated as a call to certain receiving stations without request for reply. The call is followed by two or more call

(Continued on page 112)

* Managing Secretary, A.R.R.L.

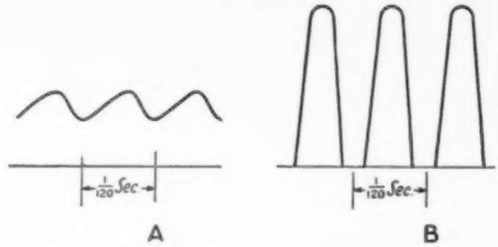


Fig. 1 — The current flowing between the center-tap of a plate transformer and the filter: A, with choke input; B, with condenser input.

Another Method of Keying With Controlled Rectifier Tubes

BY BYRON GOODMAN,* W1JPE

Those hams whose inclinations are toward pre-filter keying, but who have hesitated to oust a pair of perfectly good 866's in favor of more expensive grid- or magnetically-controlled tubes, will find this article of interest. Only one controlled rectifier tube is needed — and the existing power supply is hardly disturbed.

PRIMARY keying of power supply transformers has enjoyed a certain amount of popularity because, keying through the power supply filter, it gives a "softness" that prevents thumps and eliminates clicks. One of its major disadvantages, especially in high-power circuits, is the bad sparking at the key or relay contacts due to inductive surges from the transformer primary. This disadvantage was eliminated by the introduction of grid[1]- and magnetically[2]- controlled mercury-vapor rectifier tubes, to be used in the regular full-wave rectifier circuits. However, there is a fairly simple way to retain the desirable characteristics of rectifier keying with only one controlled rectifier instead of the usual two.

The controlled rectifier tube can be used only in circuits where the anode voltage is reduced to zero during part of the cycle, otherwise when the current has once started flowing the grid can never again regain control. For this reason the tube cannot be used in ordinary keyer-tube applications or other d.c. circuits but it can be used in rectifier circuits. Ordinarily two are used in the usual full-wave rectifier circuit, where the anode voltage is zero during one-half of the

(Continued on page 112)

* Assistant Secretary, A.R.R.L.

[1] QST, Feb., 1938, p. 34.
[2] QST, Sept., 1938, p. 42.

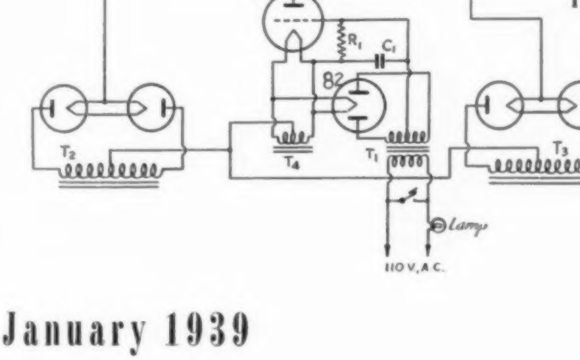


Fig. 2 — One method of applying a single controlled-rectifier to multi-stage keying.

T_1 — Bias transformer, 300-volt each side, low current, insulated for total plate voltage.
T_2 — Driver plate transformer.
T_3 — Final plate transformer.
T_4 — Keyed-rectifier filament transformer. 2½-volt, 10,000-volt insulation.
KT — Controlled rectifier tube. (Eimac KY-21 or Sheldon KY-866.)
C_1 — .25 μfd., 600-volt paper.
C_2 — 1 μfd. if driver uses high voltage and low current; 2 μfd. if driver takes low voltage and high current.
C_3, C_4, Ch — Final amplifier filter.
R_1 — 50,000-ohm, 2-watt carbon.
R_2 — 1-3 megohm, or high-voltage voltmeter.
R_3 — Driver stage grid leak.

★ WITH THE AFFILIATED CLUBS ★

A.R.R.L. AFFILIATED CLUB HONOR ROLL
All members of these are A.R.R.L. members

Baton Rouge Amateur Radio Club, Baton Rouge, La.
Bluefield Amateur Radio Club, Bluefield, W. Va.
Bridgeport Amateur Radio Association, Bridgeport, Conn.
Chester Radio Club, Chester, Pa.
Electric City Radio Club, Scranton, Pa.
Fellsway Radio Club, Medford, Mass.
Huron Radio Club, Huron, S. Dak.
Kaw Valley Radio Club, Topeka, Kansas
Moncton Amateur Radio Club, Moncton, N. B., Canada
Mound City Radio Amateurs, St. Louis, Mo.
New Orleans Radio Club, New Orleans, La.
Norfolk County Radio Association, Norwood, Mass.
Northern Nassau Wireless Ass'n, Manhasset, L. I., N. Y.
O.B.P., Chapter No. 1, St. Louis, Mo.
Pendleton Amateur Radio Club, Pendleton, Oregon
Santa Clara County Amateur Radio Ass'n., San Jose, Calif.
The Northwest Amateur Radio Club, Des Plaines, Ill.
The Portland Sevens, Portland, Oregon
Trenton Radio Society, Trenton, N. J.
Valley Radio Club, Eugene, Oregon
Yakima Amateur Radio Club, Yakima, Wash.
York Radio Club, Elmhurst, Ill.
York Road Radio Club, Glenside, Pa.

Affiliated Club Stations

The August, 1938 issue of *QST* carried a comprehensive list of calls of amateur stations operated by A.R.R.L.-affiliated clubs. Add to that list the following:

W3AQ	Delaware Valley Radio Association
W5DIG	Galveston Amateur Radio Club
W7AQ	Yakima Amateur Radio Club
W9YB	Purdue University Radio Club

A Challenge

The Northern Nassau Wireless Association would like to challenge other radio clubs to competition in the game of nine-pins, matches to be played via amateur radio. Clubs interested should communicate with the secretary, R. Weinmann, Hammond Road, Glen Cove, L. I., N. Y. . . . The N.N.W.A. is looking ahead to increased activity and has recently purchased four lots (forming a strip 40 ft. by 250 ft.), upon which the Association hopes to build a club house.

Exhibit Stations

The Delaware Valley Radio Association set up and operated its station, W3AQ, at the Trenton State Fair Grounds (Trenton, N. J.) during the week September 25th–October 1st. The layout consisted of a 300-watt rack-mounted rig on 1962-kc. 'phone (for demonstration to John Q. Public) and a telegraph rig running 100 watts on 7286 and 3535 kc. (for traffic work). W3AQ tied in with A.R.R.L. and A.A.R.S. Nets, and many messages were handled for all parts of the United States and its possessions. The D.V.R.A. is stressing the Civic Radio Center-Emergency Station idea in Trenton, and a building fund already has been established for the erection of a club house and emergency radio station. The main purpose of the exhibit at the Fair was to acquaint the public with the useful work amateur radio is doing.

The Milwaukee Radio Amateurs' Club had an exhibit station at the Wisconsin Hobby Exp.

Manchester Radio Club

Through the coöperation of the Manchester Chamber of Commerce, the Manchester (Conn.) Radio Club has secured a permanent meeting place in the Hotel Sheriden. This is the result of activities of members during the hurricane and flood. As an expression of appreciation of the community, the Chamber has placed at the club's disposal their Board of Directors' room, which seats about forty, and a banquet hall that will seat about one hundred and twenty.

A combined "house-warming" and farewell party for Mr. and Mrs. J. L. Reinartz, W1QP, who have moved to Union, N. J., was held in the new quarters, November 2d, some 115 amateurs attending. Talent from broadcast station WTIC furnished the entertainment, and R. F. Alford, W1JAM, was toastmaster. ZL2JQ, visiting at A.R.R.L. headquarters, was in attendance, and told those present about amateur radio in New Zealand. A roast beef dinner was enjoyed by all.

Monthly Raffle

The South Jersey Radio Association raffles off a "no charge" door prize each month with the following aims: (1) To check membership and visitors; (2) to aid the membership committee in getting after new members; (3) To advertise A.R.R.L. and what it has done for the amateur — the door prize is always League merchandise.

Emergency Preparedness

The Galveston Amateur Radio Club, W5DIG, is sponsor of the extensive Gulf Coast Storm Net, well known for its excellent performance during the storm season.

The Associated Radio Amateurs of Southern New England, W1AQ, has purchased a 110-volt,

(Continued on page 120)

There's no lack of information on the construction and use of equipment which will make compliance with the new amateur regulations, announced in December *QST*, easy. This article gives a few pointers, tells where to get the more detailed information you'll need if you:

(1) have a modulated oscillator on five meters;

(2) try to shoulder up to the last kilocycle in a band;

(3) are in the 900-watts-input-or-more class.

If you don't qualify in any of these there isn't much to worry about.

Technical Aspects of the New Regs

★

BY GEORGE GRAMMER,* W1DF

★

Some Suggestions on Making Equipment and Practices Conform to New Requirements

The new F. C. C. regulations [1] affect the technical operation of amateur stations in three ways: In requiring a check of the transmitting frequency by means independent of the transmitter itself; in providing that the 56-Mc. band come under the same provisions with respect to frequency stability that have been in force for the lower frequencies, and in requiring measurement of input power when power in excess of 900 watts is used. Insofar as measurement of power and frequency are concerned, the new regulations simply constitute a statement of a principle that should have represented universal amateur practice anyhow, since the responsibility for staying within a band and for keeping within the power limit always has been with the individual. The principal difference now lies in the fact that blaming the crystal is not longer a valid excuse (if it ever was) in reply to a pink slip.

Let's take the three divisions separately and see what compliance involves.

Frequency Measurement

The regulation (Sec. 152.44) says that the transmitter frequency must be checked regularly by means independent of the transmitter itself, and of sufficient accuracy to ensure operation inside the band. This works no hardship on the man who does not crowd the edges. The frequency checks can be made readily with the station receiver, provided it is capable of giving a beat note on the transmitting oscillator. The average superhet easily will meet this requirement.

If the receiver is of the type having a general-coverage "band-set" dial with a separate band-spread dial tuning a low-capacity condenser gang, it will be necessary to note quite accurately the band-set dial setting which gives the desired spread. With a "standard" set of conditions, then, a frequency calibration curve can be plotted for the band-spread dial. The handiest thing for calibrating is a simple 100-kc. oscillator [4] which can be set on frequency by checking against WWV or a broadcast station. Every ham ought to have—and use regularly—one of these gadgets, and now is a good time to build one if you haven't done it already. Nothing could be more simple or cheap, and it's a bare junk-box indeed which won't furnish most of the parts. It will give to a rather high degree of accuracy all the band edges which are even multiples of 100 kc.—better accuracy, certainly, than the receiver is capable of maintaining.

Now that we have the band edges and enough intermediate points to draw a calibration curve, it's a simple matter to make a frequency check. Turn on the transmitter oscillator, tune it in on the receiver, and note the dial setting. If it is well inside the band there's nothing further to worry about—provided you haven't picked the wrong harmonic somewhere along a string of frequency doublers! That certainly shouldn't be a factor if the transmitter is in regular operation, but is well worth keeping in mind in testing out a new rig.

Now just how much dependable accuracy does this checking method have? It depends upon a number of factors. The oscillator in a superhet is ordinarily a fairly stable job, so that it is quite safe to say that its frequency, if nothing in the receiver is changed, will not vary over 1 per cent from any predetermined value. With a decent dial, reset errors can be included in this figure. With a possible error of 1 per cent, the actual frequency may differ from that given by the calibration curve, for a given band-spread dial setting, by f kilocycles times 0.01, which comes out 35 kc. at 3500 kc., 70 kc. at 7000 kc., and so on. Since we don't know whether the error will be on the high- or low-frequency side, we have to assume the unfavorable case; that is, it is necessary to stay 35 kc. inside the edge at 3500, 70 kc. inside at 7000, 140 kc. at 14,000, and similarly on other bands. If this seems like chopping off a lot of ter-

* Acting Technical Editor.

ritory, remember this—you're depending upon a calibration which must be "safe" even if no signal can be heard in or near the band. Naturally, if a commercial marker station of known frequency, and whose position on the dial at the time of calibration is known, is on the air it can be used as a check on the calibration, and thus indicate the extent of the shift and its direction. Likewise, the 100-kc. oscillator can be brought into play if WWV or the broadcast station against which it is checked is on the air. Under these conditions, of course, the band edges can be approached with a great deal more confidence. But there are lots of times when no guideposts are at hand, and we have to be prepared to accept the resulting limitations when we operate in those hours.

If the transmitter is crystal-controlled and the crystal frequency is 10 kc. or more inside on 3.5 Mc., 20 kc. on 7 Mc., and so on, operation is pretty safe under any conditions if the receiver checks the frequency as being at its usual place in the band. The two independent frequency sources are considerably more reliable than one alone, provided they agree. It is not enough, however, to depend upon the crystal by itself.

With a small amount of preliminary work the dependability of the receiver easily can be determined. For instance, the drift under varying conditions of room temperature can be measured by comparison with a marker station or the 100-kc. oscillator. The reset accuracy can be similarly checked. The effect of disconnecting the antenna or reducing the gain to get a small enough signal can be observed. Adding all these things together (they may vary from band to band) will show the percentage accuracy that can be maintained over a considerable period of time.

In making these checks, don't forget that on cold winter mornings the shack temperature may be as much as 40 degrees below what it hits on a mid-summer day—the receiver won't forget to change its frequency accordingly.

The problem takes on a different aspect if the receiver is of the autodyne type. Here it is difficult, if not impossible, to determine with any reasonable accuracy where the transmitter frequency is in the band because the receiver usually blocks. In that case the transmitter must be tuned in on a separate monitor [2] which can be calibrated by the means already described, picking up the monitor signal in the receiver for zero-beating against the calibration points. With reasonably good construction, the monitor becomes a quite satisfactory heterodyne frequency meter.

Speaking of heterodyne frequency meters, the average well-constructed instrument of this type will give somewhat higher accuracy than the average receiver, principally because it operates under a fixed set of conditions and hence can be made rather stable. It is not difficult to maintain the accuracy within 0.2 per cent, which will permit operating that much closer to the edges of the bands; up to 7 kc. from the edge at 3500, 14 kc. at 7000, and so on. This presupposes an initial accurate calibration, regular re-checking of the calibration, a readable dial, and use only after a warm-up period to minimize drift from temperature effects. More care, of course—but that is the penalty for the supposed advantage of working near the edge of a band. Information on calibration (the 100-kc. oscillator is best) and use of such a frequency meter will be found in the A.R.R.L. *Handbook*, as well as in the bibliography appended to this article.[3]

Now for the chaps who shave kilocycles. There's no leeway here, and the highest accuracy that can be obtained is needed. The only apparent solution is the use of a good 100-kc. oscillator,[4] adjustable to exact frequency by comparison with WWV transmissions and preferably checked against a broadcast station of known frequency stability when the Bureau of standards transmissions are not available. A simple and inexpensive oscillator will suffice with *continuous* checking against a standard; the accuracy then will be nearly as good as that of the source. Without such checking it is no more dependable than the ordinary heterodyne frequency meter. The construction and use of such oscillators has been thoroughly covered in *QST*. Refinements such as a harmonic amplifier and a multivibrator which modulates the amplifier may be added, the latter particularly for measurement of frequency inside a band and for locating band edges, such as the limits of the 14-Mc. 'phone band, which are not exact multiples of 100 kc.

The preferred arrangement of this sort is one which uses a 100-kc. *crystal* oscillator. With reasonably-stable supply voltages, the frequency variation of such an oscillator will be determined almost wholly by the temperature coefficient of the crystal. If the oscillator is operated at low power so that heating from r.f. is not appreciable, the frequency change with normal room-temperature excursions will be much smaller than with a self-excited oscillator. However, the variation should be checked over a period of time against WWV so that the maximum shift can be determined, since in setting the transmitter frequency it is still necessary to allow for the variations in crystal frequency. These may be anywhere from a hundred cycles to over a kilocycle at 3.5 Mc. (or a few hundred cycles to 4 or 5 kc. at 14 Mc.) depending on the temperature range and the temperature-frequency coefficient of the particular crystal. Temperature control of the oscillator will go far to increase the 24-hours-a-day reliability. But even temperature control does not make such an outfit a second WWV, so use caution in sneaking up within a few hundred cycles of the edge.

Some useful information on the construction and use of a crystal calibrator is contained in

another article in this issue. A good deal of the discussion applies to the use of any 100-kc. oscillator, whether or not of the type actually described.

Finally, one more point must be considered when the transmitter frequency is near the edge: If the receiver or freq-meter used for checking is a.c. operated, the frequency of its oscillator is very likely to take a jump when the power goes on the transmitter — just one more factor which limits the accuracy with which measurements can be made, and in turn the distance one can legitimately go toward the edge of the band. When it comes down to a matter of cycles, it is doubtful if a reliable check is possible in the station itself; someone far enough away to get a relatively weak signal, and not affected by the same line-voltage variations, must do the job.

56-Mc. Transmitters

Speaking generally, compliance with the new stability requirements on 56 Mc. is likely to involve the use of crystal control, from preference although not from necessity. At any rate, the construction and operating technique of the lower-frequency bands must be adopted. These are familiar enough at 28 Mc., and their extension to 56 Mc. has been the subject of several *QST* articles.[5] The chief difference is in greater care in the selection of tubes and in laying out circuits for greatest operating efficiency, both of which have been the subject of considerable discussion.

For those who want simple u.h.f. equipment a shift to the 112-Mc. band is imperative. The new regulation serves a double purpose, in that it gives much needed relief of congestion on 56 Mc. and also provides an incentive for occupancy of the, until now, neglected 2½-meter band. The new *Handbook* contains new data on the construction of more effective transmitters and receivers for this band, and there will be more to come in future *QST*'s. In fact, 112 Mc. should be an ideal band for short-distance communication and emergency work, since interference from man-made static is negligible and the smaller antenna dimensions permit compact construction of effective antenna systems. And, although there has been no indication of it so far, who knows but that one of these days we'll be finding 2½-meter signals coming back from the ionosphere, just as they do now and then on five?

In thinking of u.h.f. work, don't forget that the frequency-measuring requirements apply here just as much as to the lower frequencies. The measurement technique described above can be applied to 56 Mc. quite readily, but on 112 Mc. and higher it would seem that Lecher wires constitute a good-enough check. Their use is explained in the *Handbook*.

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Power Measurement

Comparatively few of us are affected by the regulation on measuring power, and since it is a simple thing to do it needs little discussion. However, the purchase of an expensive high-voltage voltmeter is not obligatory. A good milliammeter in series with the plate-supply bleeder, plus Ohm's Law

$$\left(\text{Volts} = \frac{R\ (\text{ohms}) \times I\ (\text{ma.})}{1000}\right)$$

will give just as good an answer, provided the bleeder resistance is known to a satisfactory degree of accuracy. Commercial tolerances are too broad for this purpose, so the bleeder and milliammeter should be calibrated against a good borrowed voltmeter, or else the resistance of the bleeder should be measured accurately. If your power supply has no bleeder, this is just one more argument, in addition to the many good ones already existing, for putting one in. The plate milliammeter can be used for the measurement by putting a jack or switching arrangement in series with the bleeder, so that you don't even need an extra meter. Note, however, that the regulation says "accurate," so don't put dependence on dime store meters.

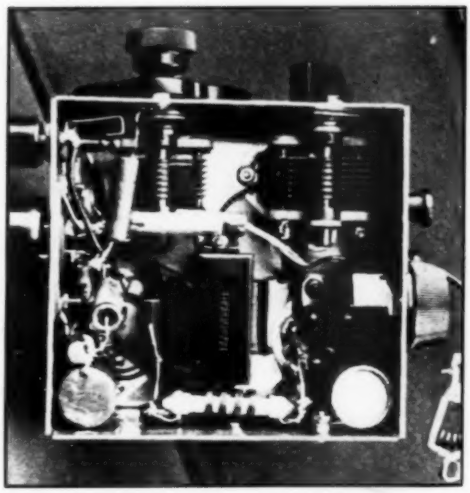
The new regulations should help solve some of our operating problems, not only in cleaning up five meters but in starting a trend, we hope, away from the nonsensical piling-up of stations at the edges of the bands.

Selectivity With the 2-Tube Regenerative Receiver

When *QST* devotees read this story about a two-tube regenerative receiver with selectivity comparable to that of a superhet, I can almost hear the gust of Gargantuan laughter sweeping the ranks. All right, laugh! If I were the reader of this instead of the writer, I, too, would bray as loud as the loudest.

In *QST* for June, 1934, there was described a two-tube regenerative receiver — in my opinion, a receiver which is still "tops" in simplicity, low cost and performance.[1] I believe it also appeared in some of the subsequent *Handbooks.* I made a lot of them. However, there were two drawbacks — lack of selectivity and the difficulty of fitting an antenna free from hum, especially on 20 meters. I recently wondered what would result if this set were made up pee-wee fashion something like the "QSL-Forty" transmitter.[2] Not being an expert and so lacking that sometimes unfortunate gift of prophecy, the only way to find out was to try it and see.

[1] Grammer, "What About the Simple Receiver?", QST, June, 1934.
[2] Sutter, "The QSL Forty," *QST*, February, 1938.



Space is at a premium underneath the chassis, but with a little care all the parts can be fitted in.

The photographs show the set on a chassis 4¾ inches by 5 inches and 3⅛ inches deep, and the thing sticking up from the antenna post is the antenna — a piece of 3/16-inch copper tubing 12 inches long. You might make it a couple of feet longer, if it does not project through the dining-room floor and interfere with the Old Man's ankles as he dunks his morning doughnut.

I don't like to refer to the set as a nice little portable (even if it be so) because the average rig called by that name is about as "portable" as an 8-hp. outboard motor.

Performance

Let's get on with a little account of the performance of the set. I have here a list of c.w. stations located from coast to coast and from Florida to the Lakes, heard on this receiver. There isn't any point in listing the calls; for one thing there is no space to spare, and you will have to take my word for it anyway.

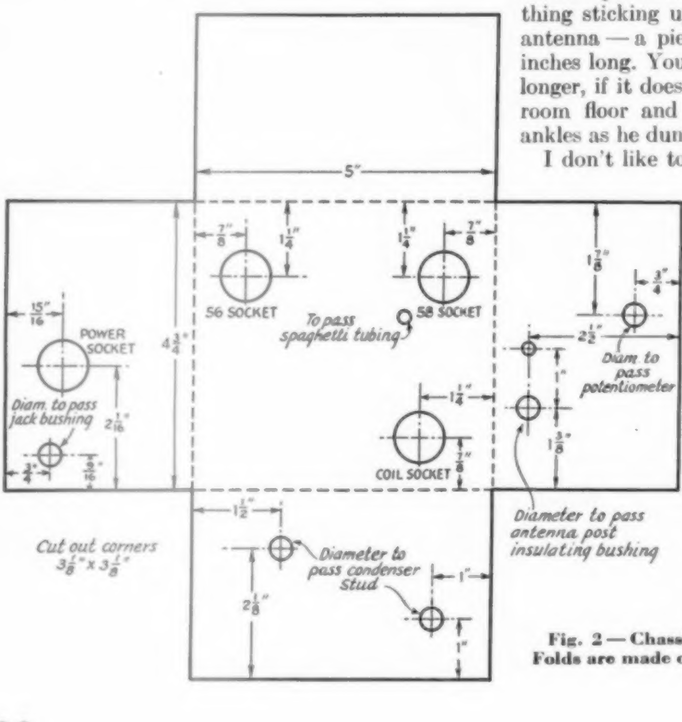
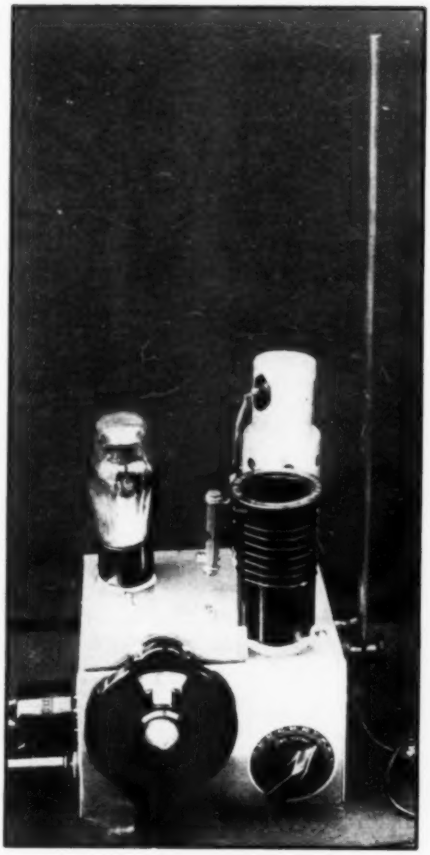


Fig. 2 — Chassis dimensions and drilling data. Folds are made on the dotted lines.



This little two-t·be regenerative receiver is just about the same size as the "QSL Forty" transmitter described by the same author in February, 1938, *QST*. The rod antenna which has given such satisfactory results is visible at the right.

A "Pee-Wee" Version of an Old Favorite

BY FRED SUTTER,* W8QBW-QDK

The secret of improving the selectivity of a simple regenerative set is even simpler than the receiver itself — use a small antenna. Yes, we know all the arguments for making the antenna as effective a "signal-sucker" as possible — but the fact remains that a regenerative detector quickly overloads on strong signals, and signals that block the detector can't readily be tuned out. Besides, weaker signals are amplified more — a surprisingly small antenna can be used, as the author points out. You don't have to build the set to take advantage of this story, although you'll no doubt be tempted to build it anyhow!

This is not offered as proof of the sensitivity of the two-tuber, about which everyone already knows, but to show that this particular set with a 12-inch antenna drags them in from far and near. To me, at least, that *was* news. Nearly all of them were nice headset volume, but a good many were uncomfortably loud, especially on 20 meters. And by the way, one 20-meter call was I2AL, Italy.

Tuning

The tuning was very sharp; a station would "peak" in about the thickness of a line on the dial, and these look to me a little less than a hundredth of an inch thick. (This dial has a spread of 3½ inches and the 40-meter band covers nearly 180 degrees.) If two stations were very close, the unwanted one would drop out, or into the background, while the other peaked up sharp and loud. Of course, after all, the final test in making a com-

(*Continued on page 114*)

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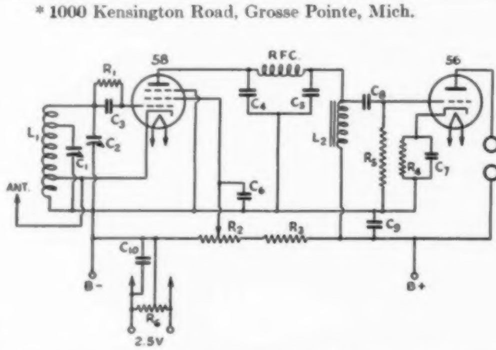


Fig. 1 — Circuit diagram of the compact receiver.

C_1, C_2 — 100-μμfd. variable (Hammarlund MC-100-S).
C_3, C_4, C_5 — 100-μμfd. mica.
C_6 — 5-μfd. 400-volt electrolytic.
C_7 — 10-μfd. 50-volt electrolytic.
C_8 — 0.01-μfd. paper, 400-volt.
C_9, C_{10} — 0.005-μfd. paper, 400-volt (capacity not critical).
R_1 — 0.5 to 5 megohms, 1-watt.
R_2 — 50,000-ohm potentiometer.
R_3 — 25,000 ohms, 10-watt.
R_4 — 2000 ohms, 1-watt.
R_5 — 1 megohm, 1-watt.
R_6 — 75 ohms, center-tapped.
RFC — 2.5-mh. r.f. choke (National R-100).
L_1 — See coil table.
L_2 — 1000-henry choke (Thordarson T-29C27).
Note: C_6 and C_7 should not be over two inches long.

Coil Data

Frequency Range	Total turns, L_1	Cathode Tap	Band-Spread Tap
1450 to 3400 kc. (1.75)	54½	3¼	29¾
3050 to 7100 kc. (3.5)	27½	1¼	11¾
6100 to 14,200 kc. (7)	13½	¾	4¼
10,600 to 24,000 kc. (14)	7½	½	1¼
18,000 to 41,000 kc. (28)	3½	⅓	½

All coils are wound with No. 24 d.s.c. wire on 1½-inch diameter forms, the length of the coil being 1½ inches in all cases. The figure in parentheses after each frequency range indicates the amateur band for which that coil is used. The taps are counted off from the lower or ground terminal.

A Dual-Frequency Crystal Calibrator

An Inexpensive Device for Indicating 100- and 1000-kc. Points in the High-Frequency Spectrum

BY F. A. LENNBERG,* W8CQQ

AMATEUR radio, like other radio communication services, must keep in step with technological development. We amateurs are given a rather free hand in the use of our frequencies, but as our number increases and radio technique advances, higher technical standards of operation are required for our mutual benefit and for the comfort of services outside of our own frequency bands.

The amateur-band limits are definitely stated and are inflexible quantities — they are as precise as frequency can be determined. We are not supposed to work outside the limits specified, but some of us, through zeal for catching elusive DX, in an attempt to obtain an essentially clear channel or just from sheer carelessness, have let our operating frequencies slip "just a little bit" beyond the legal limits. This often causes interference with other radio communication services and results in severe criticism of amateur radio. The new F.C.C. amateur regulations have placed the responsibility for maintenance of correct frequency squarely on our own shoulders. The particular rule states, in effect, that each amateur station must have some independent means for measurement of the transmitter frequency and must establish a procedure for checking it regularly. This means that an off-frequency citation from now on will really be a serious matter.

This simple device generates 100-kc. harmonics up to 20,000 kc., and 1000-kc. harmonics up to 60,000 kc. The dual-frequency crystal can be seen in the center between the two tubes. Immediately in front of the crystal is the frequency adjusting condenser. At the left bottom is the 100-kc. inductance, L, and the tuning condenser C_1, for the 1000-kc. tank. The panel controls include R_3 and the three switches shown in Fig. 1.

The frequency-checking device need not be in the actual possession of the station operator and need only be of sufficient accuracy to insure operation within the band limits. When the transmitter frequency is well within the band limits the station receiver can suffice, but when operation is very close to the band edges a precision frequency standard is necessary. Obviously, it is much better practice for each amateur to have his own checking apparatus rather than to depend on the generosity of a neighbor.

Frequency-Checking Equipment

The problem is, just what type of equipment should be used? Different types of frequency monitors have been described in past issues of *QST*, and each possesses certain advantages. The most accurate and dependable arrangement, however, is a low-frequency secondary standard the harmonics of which can be used to outline and subdivide the bands.[1] Because the frequency of the standard can be checked against transmissions from WWV, it is a reliable device independent of calibration curves, charts, etc. It can be used in conjunction with the regular station receiver, thereby simplifying the equipment and at the same time affording flexibility.

It is usual practice to choose a frequency of 100 kc. for the secondary standard. This value provides adequate calibration points for general application, and is sufficiently high that the harmonics are usable at very high frequencies. One objection to this frequency, however, is the fact that a harmonic spacing of 100 kc. is small in relation to usual receiver dial calibrations at high frequencies. As a result, it is not difficult at the high frequencies to become confused as to which harmonic is which.

The difficulty of identifying harmonics can be

* Sales Engineer, Bliley Electric Co., Erie, Pa.

[1] "A New Type of Frequency-Checking Device," *QST*, June, 1938.

eliminated through the use of two oscillators, one at 100 kc. and the other at 1000 kc. The procedure then becomes merely a matter of locating the 1000-kc. calibration points and then sub-dividing them with 100-kc. harmonics. This provides the necessary flexibility but complicates the apparatus.

It is a known fact that quartz crystals have two or more frequencies of oscillation. For instance, an X-cut crystal will oscillate at a certain frequency largely determined by its thickness and also at a much lower frequency largely determined by the length of the crystal along its so-called mechanical axis. If we intentionally grind an X-cut crystal to oscillate at 100 kc. on one dimension and at 1000 kc. on another dimension, we have a simple means for constructing a double-frequency calibration oscillator.

The manufacture of a dual-frequency crystal presents somewhat of a problem because the crystal dimensions in relation to frequency are somewhat interdependent. Changing one frequency by grinding will influence the other frequency of oscillation. It is not difficult to imagine the infinite patience and juggling ability which would be required to bring both crystal frequencies to exact specified values. This problem was solved by grinding the 100-kc. mode of oscillation so that the crystal frequency could be adjusted to exactly 100-kc. by means of a small variable condenser placed in parallel with it, and by allowing a grinding tolerance of 0.05 per cent for the 1000-kc. frequency.[2] After all, the 1000-kc. frequency is largely for the purpose of providing sign posts along the way, and its absolute frequency therefore need not be precisely 1000 kc.

A Practical Calibrator

The crystal calibrator pictured was designed around a dual-frequency crystal. This device is simple, flexible and easy to construct. It is excellent for amateur frequency monitoring and for general calibration purposes. The output is rich in harmonics and either crystal frequency is instantly available by a mere flip of a toggle switch. Usable harmonics can be obtained up to 20,000 kc. from the 100-kc. frequency and through 60,000 kc. from the 1000-kc. frequency. The exact upper limit, of course, depends somewhat on the sensitivity of the receiving equipment employed. The oscillating frequency is practically independent of loading effects because electron coupling is employed.

[2] At the present time the dual-frequency unit used by the author is manufactured to a tolerance of 0.01 per cent at 100 kc. For adjustment to exactly 100 kc. as described here it is necessary that the crystal frequency be on the high side of 100 kc.; the parallel condenser will be ineffective if the frequency is low. Crystals ground to the high-frequency side, suitable for tuning to exact frequency, will be supplied if so ordered. The suffix "A" on the type number indicates the proper type of crystal. — Editor.

The calibrator described here is a low-cost instrument capable of a rather high order of accuracy in locating the edges of the various amateur bands — at least those whose edges are multiples of 100 kc. The crystal oscillates in two modes to give 100- and 1000-kc. fundamental frequencies, the uses of which are — or should be — well known to the amateur fraternity by this time. Capable of adjustment to zero beat with WWV, the 100-kc. frequency can be maintained to a precision limited only by temperature and voltage effects, the temperature coefficient being approximately 10 cycles/Mc./degree *C.*

For wider frequency range (extending the 100-kc. harmonics to 28 and even 56 Mc.) and checking at closer frequency intervals, the oscillator output readily can be fed into an amplifier and multivibrator of the type described in June, 1938, *QST*.

Fig. 1 shows the complete wiring diagram of the instrument. Note that only a small number of inexpensive parts is required. Because the current drawn from the power supply is low, a resistance-capacity filter rather than an inductance-capacity filter is used. The filtering action is ample, since a 3-inch oscilloscope (without amplifier) connected to the d.c. output showed no trace of a.c.

A double-pole double-throw toggle switch, Sw_1, is used to select the proper tank for either crystal frequency. It should be noted that this switch also disconnects condenser C_6 when the crystal oscillates at 1000 kc. In the original model C_6 was permanently connected across the crystal but it was found that the added capacity greatly decreased the activity at 1000 kc., and the crystal became quite sluggish in starting. Disconnecting C_6 by Sw_1 completely cured this difficulty. The leads between C_6 and Sw_1 should be kept reasonably short and placed to keep any stray capacity at a minimum. Since we are dealing with relatively low frequencies, however, it is not necessary to go to exceedingly great pains to keep all leads physically short.

For easy detection of the calibrator harmonics in a receiver, it is often advantageous to modulate the calibrator output. Modulation in this instrument is obtained by connecting the plate of the oscillator tube to the input of the power supply filter. Switch Sw_2 provides instantaneous choice of a modulated or unmodulated output. The screen-grid of the 6F6 tube is always fed with d.c. to prevent frequency modulation which could occur were the screen also connected to the filter input at the same time.

The output control, R_3, is not essential but is advantageous in preventing receiver overloading, especially when the calibrator output is allowed to beat in the receiver with a weak incoming signal. For simplicity, R_3 and the power switch Sw_1 are combined into one unit. The operation

of the output control did not come up to expectations in the original model due largely to the fact that no shielding of the output leads was used and partly to radiation coupling between the calibrator and the receiver. The use of a shielded lead to the output terminal would undoubtedly have increased the effectiveness of the control several times.

The alternate attenuator diagrammed helps to decrease the effects of radiation coupling because the receiver input sensitivity is reduced at the same time that the calibrator output is attenuated. This arrangement can be used to advantage in amateur practice because it provides a simple means for shorting the receiver r.f. input when the station transmitter is turned on for a frequency check. The disadvantage of the system, however, occurs when low output from the calibrator is desired, since the receiver sensitivity is reduced by the action of the attenuator. Either attenuator has its advantages, but the original arrangement is best for general calibrator purposes.

Switch Sw_3 offers a simple means of disconnecting the calibrator from the receiver without disturbing the attenuator setting. The switch, however, will be highly effective only when the output lead is shielded to prevent stray pick-up from the calibrator itself.

Preliminary Checks

The tuning condenser C_1 for 1000 kc. is not critical and can be adjusted without the use of meters. Connect the calibrator to the receiver and tune the receiver to some frequency at which a 1000-kc. harmonic should appear. Adjust C_1 until the crystal oscillates and leave the adjustment at a point where the crystal starts readily when Sw_1 is thrown to the 1000-kc. position.

To adjust the crystal frequency to 100 kc., tune in WWV on 5000 kc. The standard frequency schedules for WWV are published in each issue of *QST*. WWV transmits on 5000 kc. (with 440-cycle modulation) daily, except Saturday and Sunday, between 4:00 P.M. and 2:00 A.M., E.S.T. Couple the calibrator to the receiver and set Sw_1 for 100 kc. A beat note will be heard which is the result of the 50th harmonic of the oscillator beating against WWV. Adjust C_6 until the beat frequency reduces to zero. If the receiver is equipped with an S-meter, the meter will follow the beats when the frequency difference becomes a matter of only a few cycles. By watching the meter motion, you can easily determine when the beat is reduced to zero.

If the adjustment is made when WWV is modulated at 440 cycles, *be sure* that you observe the beat between the *carrier* and the calibrator harmonic. It is possible to obtain a beat against one of the side bands and this, of course, is incorrect. When the tone-modulation is broken for a station announcement, the beat should remain the same; if incorrect the beat will be 440 cycles.

Don't expect the calibrator to hold zero beat for indefinite periods of time. Temperature changes and oscillator voltage variations will cause small shifts in frequency. This is to be expected and can be eliminated only by temperature control and the use of a voltage regulated supply — refinements which are necessary only if an extremely high degree of precision is wanted.

Calibrating

For calibrating a receiver, simply connect the calibrator to the receiver antenna post and note the dial settings at which the calibrator harmonics

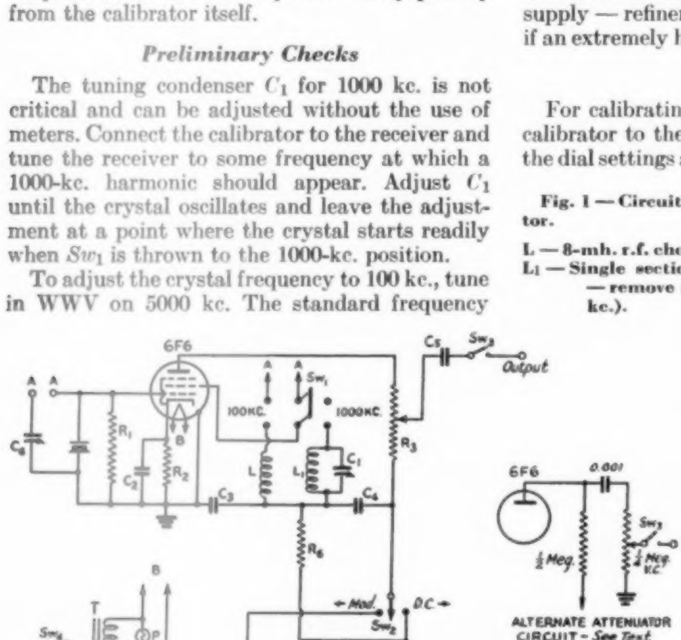
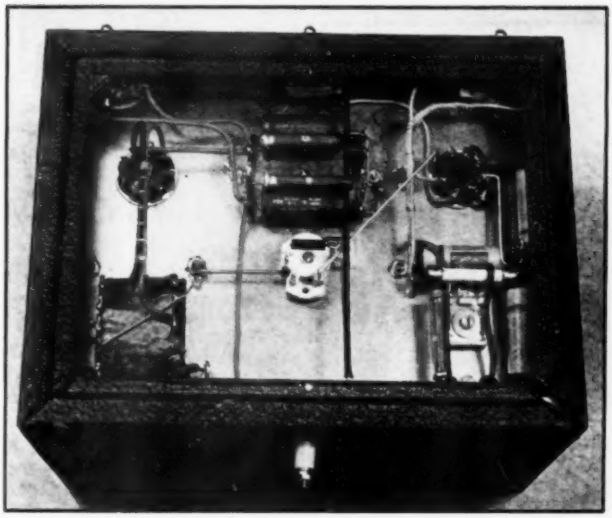


Fig. 1 — Circuit of the 100-1000-kc. crystal calibrator.

L — 8-mh. r.f. choke (for 100 kc.)
L_1 — Single section of a 2.1- or 2.5-mh. r.f. choke — remove all but 1 coil from the form (for 1000 kc.).
C_1 — 100-μμfd. mica trimmer condenser.
C_2, C_3, C_4, 0.1-μfd. paper condenser.
C_5 — 0.001-μfd. mica.
C_6 — 25-μμfd. midget air condenser.
C_7, C_8 — 4-μfd. dry electrolytic.
R_1 — 5 megohms, ½-watt.
R_2 — 500 ohms, 1-watt.
R_3 — ½-megohm volume control and power switch (Sw_4).
R_4 — 10,000 ohms, 1-watt.
R_5 — 20,000 ohms, 1-watt.
R_6 — 25,000 ohms, 1-watt.
Sw_1, Sw_2 — D.p.d.t. snap switch.
Sw_3 — S.p.s.t. snap switch.
Sw_4 — (see R_3).
T — Power transformer 6.3 v., 5 v., and 640 v., c.t. (Kenyon K4OMY or similar).
X — 100-1000-kc. dual-frequency crystal (Bliley type SMC100A).



Note the simplicity of layout and wiring. The power supply is at the left and the r.f. end is at the right. The variable condenser in the center is in parallel with the cyrstal to provide a frequency adjustment. The r.f. output is fed to the feed-through insulator at the bottom of the picture. The single pie r.f. choke, at the center left, is L_1. Sw_2 is at the left top, Sw_3 at the center, and Sw_1 at the right.

appear. The use of modulation will assist in locating the harmonics. If the receiver has an S-meter, the dial setting for each harmonic can be accurately determined by tuning for maximum reading. It will, of course, be necessary to start from some known frequency in order to determine the frequency of each successive harmonic. This presents no particular problem because there is an ample supply of radio stations which will serve as markers. The frequency of the station need only be known to a degree sufficient for identification of the first calibrator harmonic to be used. All other frequencies, in a series, are then known because each successive harmonic differs from the preceding harmonic by the fundamental oscillator frequency. For instance, if the first harmonic used from the 100-kc. oscillator frequency is 7000 kc., harmonics will appear at 7100 kc., 7200 kc., 7300 kc., etc. Naturally, care must be taken not to skip a single harmonic for that would upset the calibration.

When working at low and medium-high frequencies, only harmonics of the 100-kc. calibrator frequency need be used. At high frequencies, however, it is best first to locate 1000-kc. points and then to subdivide them by harmonics from the 100-kc. frequency. This prevents confusion where the 100-kc. calibration points are close together and it would be easy to miss a count or two. Once the procedure is understood, a complete receiver calibration can be effected in a short space of time.

For calibrating a variable oscillator, feed the output from both the calibrator and the oscillator into a suitable receiver. Tune to each successive calibrator harmonic with the receiver and set the oscillator to zero beat with each harmonic. In this way the calibration can proceed at a rapid rate. Be sure that the fundamental of the oscillator rather than a harmonic is picked up in the receiver. Of course, harmonics of the oscillator can be used just as well, but calculations to correct for the harmonic order will be required.

The frequency of any signal can be determined with fair accuracy by interpolation in a receiver. Note the dial settings at which the signal and the two adjacent calibrator harmonics appear. Elementary arithmetic will then provide the answer. The final accuracy will depend upon the precision to which the dial readings can be determined and the linearity of the receiver between the measuring points.

For the uninitiated, it may be pointed out that interpolation is a process of determining an unknown by its relation to known values. Let us assume that the frequency to be measured appears at dial setting 26.6 while adjacent 100-kc. harmonics appear at 15.1 and 55.1. From the receiver calibration it is determined that the harmonic at 15.1 must be 3200 kc. while the harmonic at 55.1 must be 3300 kc. This means that the signal frequency must be between 3200 kc. and 3300 kc. There are 55.1 minus 15.1 or 40 dial divisions between the harmonics. The frequency difference is 100 kc., therefore each dial division represents $100 \div 40$ or 2.5 kc. Since the unknown signal is 26.6 minus 15.1 or 11.5 divisions higher than 3200 kc., its frequency must be 3200 kc. plus 11.5×2.5 or 3228.75 kc.

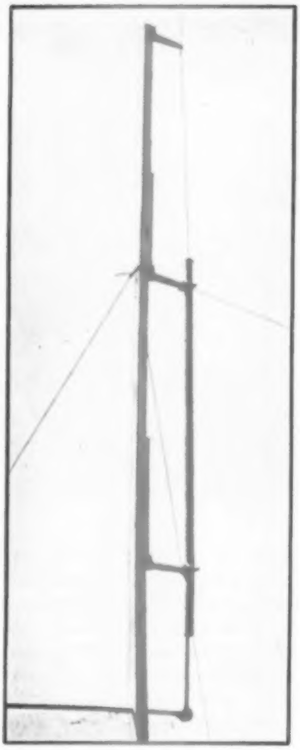
If the signal being measured is very near the edge of the band, it may be difficult to interpolate with reasonable accuracy. In this case, allow the signal and the calibrator harmonic to beat together in the receiver so that an audio-frequency note will be produced. The frequency of the note will then be the frequency difference between the signal and the calibrator harmonic. This fre-

(Continued on page 59)

The Coaxial Vertical Radiator

An Improved Half-wave Antenna System for Low-Angle Radiation

BY JOHN J. LONG,* W8ABX



The coaxial antenna installed at W8XAI, mounted on stand-off insulators on a wooden pole. This installation uses a commercial ⅞-inch concentric feed line. The lower quarter wave section of the antenna through which the line runs is two-inch tubing. Less expensive arrangements can easily be devised for amateur work. A portion of the ground screen is just visible at the bottom.

THE antenna to be described was first used, so far as the writer knows, by the Western Electric company for their new ultra-high-frequency police transmitters. Although the antenna gives exceptional results, very little information has been available on why it works as well as it does. The explanation to be given later is simply that of the present writer. The results, however, are real — so real that any one wishing to operate on 5 or 10 meters will do well to put up such a rig.

Briefly, the antenna is a simple half-wave vertical dipole with the power fed into the center by running the concentric-line feeder up through the lower quarter-wave section of the dipole. This can be done by any number of mechanical arrangements, and two such arrangements, used experimentally at W8XAI and W8PK, will be described. W8PK operated on five meters and W8XAI on 31.6 Mc.

At W8XAI, a ⅞-inch isolantite-insulated coaxial line was used to feed the dipole. A piece of two-inch copper tubing was soldered to the end of the line by placing a disc of copper at the top, as shown in Fig. 1. The upper quarter-wave section was mounted on an insulator, and consisted of a piece of quarter-inch brass tubing. The whole assembly was mounted on insulators as shown in the photograph. The antenna power was 100 watts, and tests were made with different members of the WHAM staff and other listeners in Rochester, 16 miles away, to get information on how this antenna compared with a "J" type antenna which was formerly used. The new type of feeder system was so superior to the old that the improvement was very impressive.

The end-fed "J" type antenna is shown in Fig. 2, while the type used at W8XAI is shown in Fig. 3. This antenna feed system was quite unsatisfactory. On one test, the half-wave antenna was disconnected from the feeders and practically the same signal strength was reported as when the antenna was on, showing that the feeders were radiating considerable energy all by themselves! It so happened that the feeders were in a very unfavorable spot for doing much radiating, so most of the power was being wasted in heating the shielding on the building.

Ground Screens

We have been reading about the theoretical half-wave antenna erected over perfectly-conducting earth for so long, and never seeing one in operation, that we were pretty well disgusted with the theoretically-perfect antenna. It looked beautiful on paper but there just didn't seem to be any perfectly-conducting earth on this particular globe. We had some copper screen left over which was used for shielding our transmitter building, and which was supposed to be the last word in conductivity. We said, "Why not set up a piece of synthetic perfectly-conducting earth under our half-wave antenna and see what happens?" A test was made by placing this copper screen directly under the antenna, and reports at once showed that the theory was right, but that the earth as we know it was not so hot.

It is a simple matter to place a good ground screen at least a half wavelength in radius under a five- or ten-meter antenna. We wish it were as simple in the broadcast band!

Five-Meter Results

Before we get to the cracker barrel opinion on what happens with a vertical "J" antenna, let's see what W8PK did with a five-meter antenna built along the same lines.

He did not have a rigid piece of concentric line available so he made up the rig shown in Fig. 4.

* Chief Engineer, WHAM; 63 Sonora Parkway, Brighton, N. Y.

The concentric line consisted of a piece of low-grade No. 14 rubber-covered house wire pulled through a length of quarter-inch brass tubing. A piece of ⅞-inch copper tubing was soldered to the end of it, and the top quarter-wave section was an extension of the inner conductor. The whole assembly was suspended from the top by a regular antenna insulator.

The boys on "five" said it was as loud as a beam job that he spent considerable time building — minus the trouble of having to go out and turn it whenever he wanted a different direction. The thing puts an R9 signal into W8ABX, 18 miles away, on five meters. The beam job never did that. Maybe he didn't have the beam operating at maximum efficiency, but that is the point — there are plenty of beams that are not working to the utmost! Just because the signals get weaker when the antenna is turned in the opposite direction is no sign that it is working efficiently in the direction at which it is pointed.

There was some doubt about the length of the lower quarter-wave section, but it was found by using a sliding sleeve on the outer tubing that the length was the same as that of the upper section, and came out exactly as calculated. Forty-eight inches for 56.5 Mc. will give you some idea of the lengths for other bands.

Why It Works

Now for some guessing: Apparently a vertical "J" type antenna with a vertical quarter-wave "Zepp" type matching section at the end of the half-wave antenna has voltage which is out of phase in each side 180 degrees. But looking at it from the antenna's angle, the feeder becomes part of the antenna if it does any radiating itself.[1] If this setup is operated above a ground, it is a ¾-wave antenna. A ¾-wave antenna has a very husky lobe of high-angle radiation and a weak lobe of practically horizontal radiation. This is so when the antenna is above perfectly conducing earth! Wasting all of the main part of the radiation in a high-angle lobe is not good "ham radio" at these frequencies. Anyway this new method of feeding is doing its stuff, so why worry with theory which is only correct when figured over perfectly-conducting earth — of which there is none!

To check the idea, a vertical dipole was supported from a concentric line out of the attic window at W8ABX as shown in Fig. 5, thereby

This is a description of the new Western Electric antenna developed for u.h.f. police work. Installed at short-wave broadcasting station W8XAI, its performance was so evidently superior to the old "J" type that the hams on the staff just naturally had to give it a workout on amateur bands, with the results recounted in this article. It should be excellent for 5-meter work, since it is designed to give more intense low-angle radiation than it is possible to achieve with the more conventional forms.

[1] At 56 Mc. in particular, it is doubtful whether a line with 6-inch spacing can be considered to be at all near the non-radiating condition. This spacing begins to approach the 1/20th wave spacing which, with out-of-phase currents, forms an effective radiating system. See p. 18, *QST*, May, 1938.

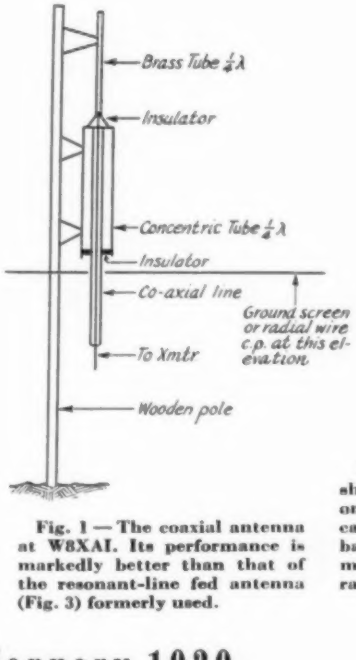


Fig. 1 — The coaxial antenna at W8XAI. Its performance is markedly better than that of the resonant-line fed antenna (Fig. 3) formerly used.

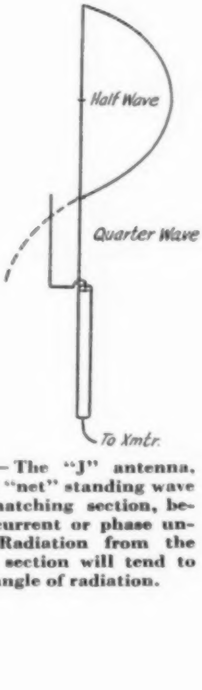


Fig. 2 — The "J" antenna, showing a "net" standing wave on the matching section, because of current or phase unbalance. Radiation from the matching section will tend to raise the angle of radiation.

Fig. 3 — The old W8XAI antenna, used before the coaxial antenna was installed.

eliminating the vertical matching section. This antenna gets better reports than were ever obtained with an end-fed job.

Remember this: An antenna with power being fed into it is not the same as a theoretical antenna in free space. If the feeders radiate any energy which will interfere with the radiation pattern of the antenna itself no one can tell what is happening without making an elaborate field-strength survey. This is not being done by the average ham.

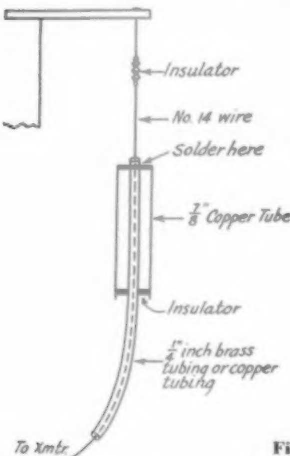


Fig. 4 — The 5-meter coaxial antenna built by W8PK, using materials easily available to the average amateur. This antenna gave a good account of itself as compared to a rotary beam.

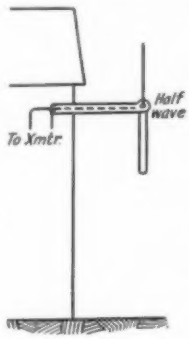


Fig. 5 — Vertical antenna with horizontal feed line as installed at W8ABX to check the effect of feeders. Results were definitely superior to those with the same type of antenna but with the feeder system vertical.

After all this talk you will probably say, "My antenna is the best one I ever tried." OK, but don't say we didn't tell you about the "theoretically-perfect" vertical half-wave antenna!

Editor's Note. — This article was written before the coaxial antenna had been described in print by its designer, Arnold B. Bailey, of the Bell Telephone Laboratories. Subsequently an article by Mr. Bailey appeared in the September, 1938, issue of *Pick-ups*, monthly publication of the Western Electric Company. The principle of operation is essentially as outlined by W8ABX, the intention being to eliminate radiation from the feeder system and, in the case of the common form of u.h.f. police antenna, from the grounded metal pole of which the top section is usually considered to be the radiating antenna. The inner surface of the quarter-wave tube can be considered to be an extension of the outer surface of the coaxial transmission line and does not carry current (except when power is coupled into it, as in the case of a nearby antenna). The outer surface, however, acts like the lower quarter-wave section of a vertical half-wave antenna; the current does not penetrate below the surface because of skin effect. The quarter-wave tube and the section of coaxial line it encloses can be looked upon as a high-Q circuit, so that a large potential difference appears between the lower end of the tube and the line proper. This is equivalent to placing a wave-trap in series with the lower end of the antenna and the outer surface of the concentric feed line, with the result that practically no power is transferred to the outer surface of the line itself; hence no current flows in it and it does not radiate. Tests carried out by Bell Labs have shown that an average signal-strength increase of 8 db results when the coaxial antenna is substituted for the ordinary "J."

It should be pointed out that, except for reduction of feeder (and pole) radiation the coaxial antenna is not a more "efficient" antenna, in the sense that it radiates more of the power supplied to it than does the ordinary half-wave dipole; it is, in fact, still a half-wave dipole. Its greater effectiveness lies in the fact that it eliminates stray radiation and thus permits the dipole to approach its theoretical performance in concentrating radiation along the horizontal. In other words, more of the radiated power will be pushed along the ground — the place where it is wanted in the case of normal u.h.f. work. Since low-angle radiation is desirable for long-distance 28-Mc. work, the antenna should also be highly effective for DX as well as local work on that band.

Incidentally, W8ABX's suggestion of using a ground screen under the antenna is well worth considering, particularly at these frequencies. Several of the WHAM gang have found such screens to increase materially the effectiveness of the antenna,[2] and at 56 and 28 Mc. the area to be covered is not large (a circle a wavelength in diameter at most). In a recent conversation, W8ABX suggested that a radius of 0.3 wavelength should be sufficient, since the current tends to concentrate at this point, and that tests had shown that going beyond this distance to a radius of a half-wavelength did not appreciably improve the results. — *G. G.*

[2] W8EBS reports that the use of a chicken-wire ground screen under his 10-meter rotary beam has improved the output very noticeably, making it better than the coaxial antenna, as would be expected. He also reports that the radiation angle could be changed to suit the station he was working, which also is according to the book. The screen should be a half wave below a horizontal antenna for lowest angle of radiation. Under a vertical antenna, the screen should be placed near the bottom of the lowest vertical element.—Author.

Strays

In your haste to see How's DX did you notice the dope on Regs? One concerns the Cairo Conference and the other clears up the technical difficulties of the FCC Regs.

Construction and Alignment of the Television Receiver

R.F. and I.F. Coupling Units—Test Equipment—Performance Curves

BY C. C. SHUMARD*

In December *QST*[1] the circuit of the superheterodyne television receiver was given, as well as a functional analysis of the various stages. In this article, the construction of the "hand-tailored" parts will be described. The alignment and operating procedure will be explained in detail.

CONSTRUCTION

R.F. Input Stage Assembly

In photo "A," the lower right-hand unit shows the r.f. and antenna coil assembly, with switch S_1 (refer to Fig. 2 of December *QST*) mounted on a 3-legged bracket above the coil form. Design data for the three coils (L_1, L_2 and L_3) are given in Fig. 4. The coil form is made of thin-walled bakelite tubing. The single-turn antenna coil, wound with No. 14 enameled wire, has its output leads crossed over for a distance of about $\frac{1}{4}$ inch; the leads then go through separate holes in the chassis to the two-lug terminal strip mounted on the opposite side of the chassis. These leads are short enough to make the antenna coil self-supporting — it is not directly fastened to the coil form, except on the ground lug where the center-tap connection is made. Another view of this unit is shown in photo "B" (at left). The various by-pass condensers and resistors are mounted around the coil form, with very short leads.

As even the most casual reader must know by this time, the design of coupling circuits which will pass the extraordinarily wide frequency band necessary for good picture reception is one of the most critical features of a television receiver. In this article, a continuation of the one by the same author in December *QST*, the construction of these circuits is discussed in detail. The exact dimensions given, as well as the carefully worked out alignment procedure, should enable the constructor to get the receiver into operation with a minimum of trouble. In conjunction with the deflection circuits for small cathode-ray tubes described in October *QST*, it constitutes a complete television receiving system. Data on using electromagnetic-deflection tubes and on the new electrostatically-deflected Kinescopes will be given in a subsequent issue.

It may have been noted that the parts list given in the legend of Fig. 2, December *QST*, is quite specific as to the particular parts employed. Many of the parts were carefully chosen for small physical size, so that they would go in the rather limited space available in the shielded units.

Oscillator-Mixer Stage Assembly

Photo "A" (upper unit) shows the oscillator-mixer coil assembly, with switch S_2 mounted at the top. Design data for coils L_4, L_5 and L_6 (circuit constants are referred to Fig. 2) are given in Fig. 5. The oscillator coils L_5 and L_6, wound with heavy enameled wire, are held in place by the pressure of the wire on the coil form, assisted by the short, stiff output leads soldered to nearby circuit parts. Coil L_4 is held in place by small soldering lugs riveted to the form at each end of the winding. Collodion, used sparingly, also helps to hold the windings in place. The coil form is of the same material as in the r.f. unit.

I.F. Coupling Units

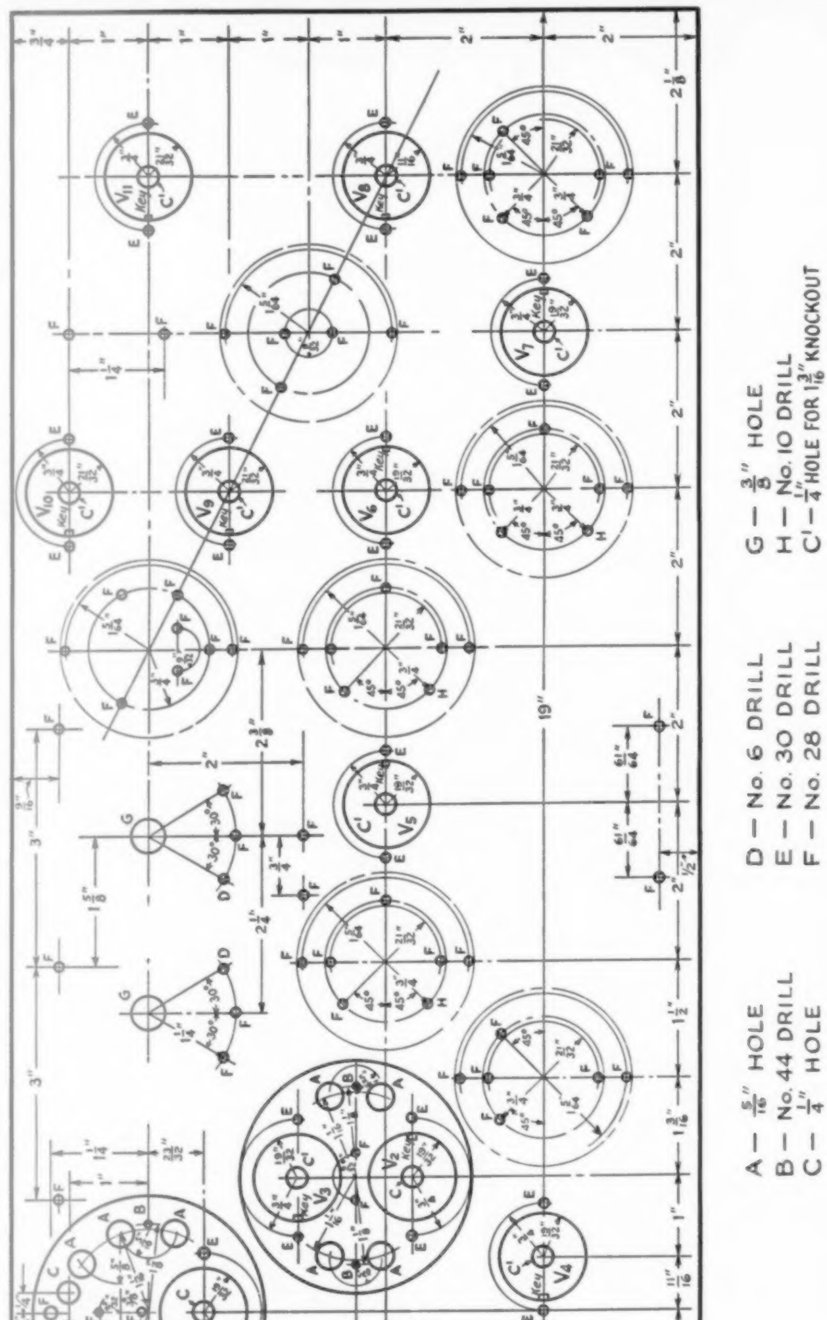
The design of the four i.f. coupling units and of the sound-buffer coil assembly is quite similar, so that it is worth while to make a metal template for the "base plates" used in each of these units. This template, shown in Fig. 6, can also be used to mark the coil forms and shield cans for drilling. The material used for the base plates and coil forms is a special grade of hard rubber, "Radio X2B" compound, made by the American Hard Rubber Company, New York, N. Y. This material is used principally because of its low leakage, which is important in the i.f. coupling units in order to avoid leakage currents through the a.g.c. circuit. The dimensions of the base plates are $3\frac{15}{16}$ by $1\frac{1}{8}$ by $\frac{5}{32}$ inches.

Photo "C" shows an assembled i.f. unit, with the various condensers and resistors mounted around the coil form and on the base plate. Design details of the i.f. coils are given in Fig. 7, and are exactly the same for all four i.f. units. The i.f. coil forms ($3\frac{15}{16}$" long) are cut from solid, hard-rubber rods $\frac{1}{2}$ inch in diameter, made of the same hard-rubber material as the base plates.

* RCA Manufacturing Co., Inc., Harrison, N. J.

[1] C. C. Shumard, "A Practical Television Receiver for the Amateur," *QST*, December, 1938.

FIG. 3 FRONT VIEW DIMENSIONAL DRAWING — TELEVISION RECEIVER PANEL



Sound Buffer Input-Coupling Unit

The input-coupling unit of the sound buffer stage is constructed very much like the i.f. units, as can be seen from photo "D." Coil design data for this unit (L_7 and L_8) are given in Fig. 8. The coil form is made of thin-walled bakelite tubing, as used for the r.f. coils.

Video Input-Coupling Unit

The two coils comprising the input coupling and compensating unit (L_{21} and L_{22}) of the video amplifier stage are shown in photo "E." Design data for the windings are given in Fig. 9. The coil forms are similar to those used in the i.f. units. The inductance values of L_{21} and L_{22} are important. These coils, in conjunction with the circuit and tube capacitances present, compensate the video input circuit so that the desired video characteristics are obtained. No adjustment of the video input circuit should be necessary if the coil and layout specifications are followed closely.

Video Output-Coupling Unit

Photo "F" shows the output coupling and compensating unit of the video amplifier. Design data for inductance L_{23} are given in Fig. 10. The output compensation provided by L_{23} should be satisfactory where the Kinescope grid terminal is placed close to the video output network. Such placement minimizes the Kinescope input-circuit capacitance.

General Circuit and Wiring Considerations

The wiring of the receiver, in general, should follow good practice for ultra-high-frequency equipment. All h.f. grounds should be made direct to the chassis with the shortest possible leads. All leads carrying high frequencies should be kept reasonably clear of other wiring and circuit components.

The "hot" plate and grid leads of the r.f. oscillator, mixer, i.f. sound buffer, and video stages are wired with single strands of No. 30 wire, insulated with spaghetti tubing where necessary; in some cases, no insulation is used except where the leads pass through the chassis or through a shield can. The use of this small wire, carefully spaced from all grounded parts, is important in reducing unwanted capacitive effects.

One side of the common heater winding is grounded; the other side of the heater supply circuit is by-passed to ground directly at the socket of each r.f. and i.f. stage.

Test Equipment and Alignment Procedure

The exact alignment of a receiver is usually a laboratory operation. However, it is believed that if the specifications which have been given are followed closely, the alignment of the i.f. coupling stages will be the only job requiring special test apparatus. A calibrated oscillator covering the i.f. frequency band and a good vacuum-tube voltmeter are required, in addition to the auxiliary short-wave "sound" receiver mentioned in the preceding article.

Changes in Receiver Constants

Since publication of the television receiver circuit in December *QST*, further work with the receiver indicates that the following changes in circuit constants are advisable in the interests of better performance from the hum standpoint:

Component	*Old Value*	*New Value*
C_{78}	50-μfd., 25-volt elec.	100-μfd., 25-volt elec.
C_{66}	0.01-μfd., 200-v. paper	50-μfd., 25-volt elec.
C_{70}	0.05-μfd., 400-v. paper	0.002-μfd., 400-v. paper

Resistor R_{41} should be eliminated.

Test Oscillator

A test oscillator covering a frequency range from about 8 to 14 Mc., and having an output voltage at low impedance adjustable up to about 0.3 volt, is necessary for the i.f. and sound-buffer line-up. It is, of course, also essential that the r.f. output voltage for a given attentuator setting should remain substantially constant throughout the frequency range employed.

An RCA Type 153 test oscillator [2] was used to align this receiver. In using the Type 153 oscillator, it was considered desirable to make a slight change in its output circuit before starting the alignment procedure. A 40-ohm carbon resistor was inserted between R_{13} and R_{14} (see Figs. 11 and 12). The reason for this will be explained later. Two different methods of coupling the test oscillator to the receiver were employed. For i.f. unit No. 4, next to the detector, a fairly large signal voltage is required because the gain of only this one stage is effective. For the line-up of this stage, the oscillator is coupled to the i.f. tube grid by means of the coupling network C_1, C_2, R_2 and R_3. The lead to C_2 is broken at point "X" (see Fig. 12) and connected with a short lead directly to the oscillator output terminal marked "Medium." The same connection is also used for i.f. unit No. 3, the oscillator signal being suitably reduced by means of the attenuator, R_{12} (Fig. 11). The transmission line shown in Fig. 12 is not used for units 4 and 3, and is left unconnected at both ends during their alignment.

For the line-up of i.f. units Nos. 2 and 1, the transmission line, consisting of a short length of shielded wire having an impedance of about 50 ohms, is connected as shown in Fig. 12. The 40-ohm resistor previously inserted allows both

[2] This is an inexpensive all-wave (100–30,000 Kc.) test oscillator of the type included in the usual service-man's kit. — EDITOR.

the input and output terminations of the line to be made 50 ohms, which approximately matches the line impedance. The use of the line for the two high-gain stages permits the signal voltage to be applied directly between the tube grid and ground, and minimizes pick-up and feedback which might exist with direct wire coupling. The magnitude of the oscillator output voltage cannot easily be determined, but this is not essential. It is more important that the oscillator voltage should be substantially constant over the i.f. band.

Vacuum-Tube Voltmeter

Because of the very high frequencies involved, the vacuum-tube voltmeter employed must have a very low input capacitance. A v.t. voltmeter using a 954 Acorn tube was described in *QST* for May, 1935.[3] An instrument of this general type is suitable for the alignment work. A sensitive microammeter should be used for the indicating meter. One requiring 200 μa. for full-scale deflection is suitable. The v.t. voltmeter should be designed and calibrated for at least two ranges. The maximum voltage for these ranges should be about 0.8 volt and 2.5 volts. Space limitations preclude more complete information on the design of tube voltmeters, but good references dealing with this subject are available.

I.F. Alignment

With the test equipment all at hand, the alignment procedure can be started. The last i.f. coupling unit (No. 4) is, of course, first to be aligned. No connections need be made from the receiver to the scanning unit. As a preliminary, it is advisable to short-circuit the plate of the r.f. tube and of each i.f. tube (except V_7) to the + B lead, by means of a direct wire jumper. Oscillator tube V_3 can be left out of its socket. These precautions prevent any possible output from the shorted stages and do not seriously upset the voltages from the power supply unit. The general procedure is as follows:

[3] The probe type or "gooseneck"; *QST*, May, 1935, p. 90.

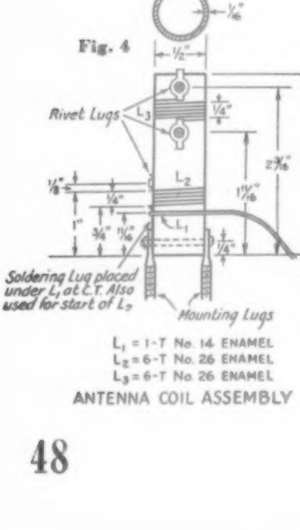
Connect the common a.g.c. bias lead (see Fig. 2, December *QST*) to the − 3 volt end of R_{57}, instead of to R_{54}, so that the tubes will get their bias, temporarily, direct from the power unit. Connect the test oscillator to the grid of V_7, using the coupling method explained under "Test Oscillator." Remove the i.f. shield can, disconnect the high side of C_{63} (the detector plate-circuit condenser) and substitute the short v.t. voltmeter input leads to the 954, from the detector plate to ground. The 6H6 is left in its socket. Set C_{60} to about ¼ maximum capacity and replace the shield can. Adjust the test oscillator for a suitable output and set the v.t. voltmeter on its most sensitive scale. The voltage output or response curve of i.f. unit No. 4 can now be obtained.

For any i.f. stage, the output curve will have two peaks, as in Fig. 13-B, when proper adjustment is made. The frequencies at which the two peaks occur can be used as an "index" of the alignment. Fig. 13-B may be taken as typical of what is desired. The peaks on this curve occur at about 10.6 Mc. and 12.8 Mc., and will show quite plainly as maximum readings on the v.t. voltmeter as the test oscillator is tuned rapidly through the desired frequency range. The frequency range being covered should be mentally correlated with the v.t. voltmeter readings so that the general shape of the curve can be visualized readily without the curve actually being plotted on paper.

For the first trial, some curve such as Fig. 13-A may be obtained. Here, the low-frequency i.f. peak is very large and the high-frequency peak is almost non-existent. This type of curve indicates that the capacitance of C_{60} is too large. Curve 13-C shows the effect of too small a value for C_{60}. Some intermediate setting of C_{60} should give the desired curve, 13-B.

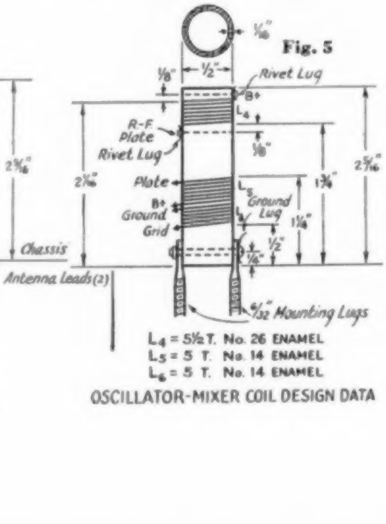
It will be noted that this curve drops more rapidly at the 10.5-Mc. end than at the 13-Mc. end. This is the effect of the series-coupling circuit $L_{19}C_{62}$ (also of $L_{16}C_{54}$, etc.), which should tune to approximately 8.5 Mc. The nominal value of

Fig. 4



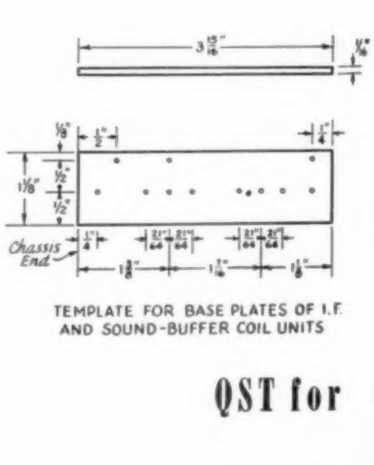
L1 = 1-T No. 14 ENAMEL
L2 = 6-T No. 26 ENAMEL
L3 = 6-T No. 26 ENAMEL
ANTENNA COIL ASSEMBLY

Fig. 5

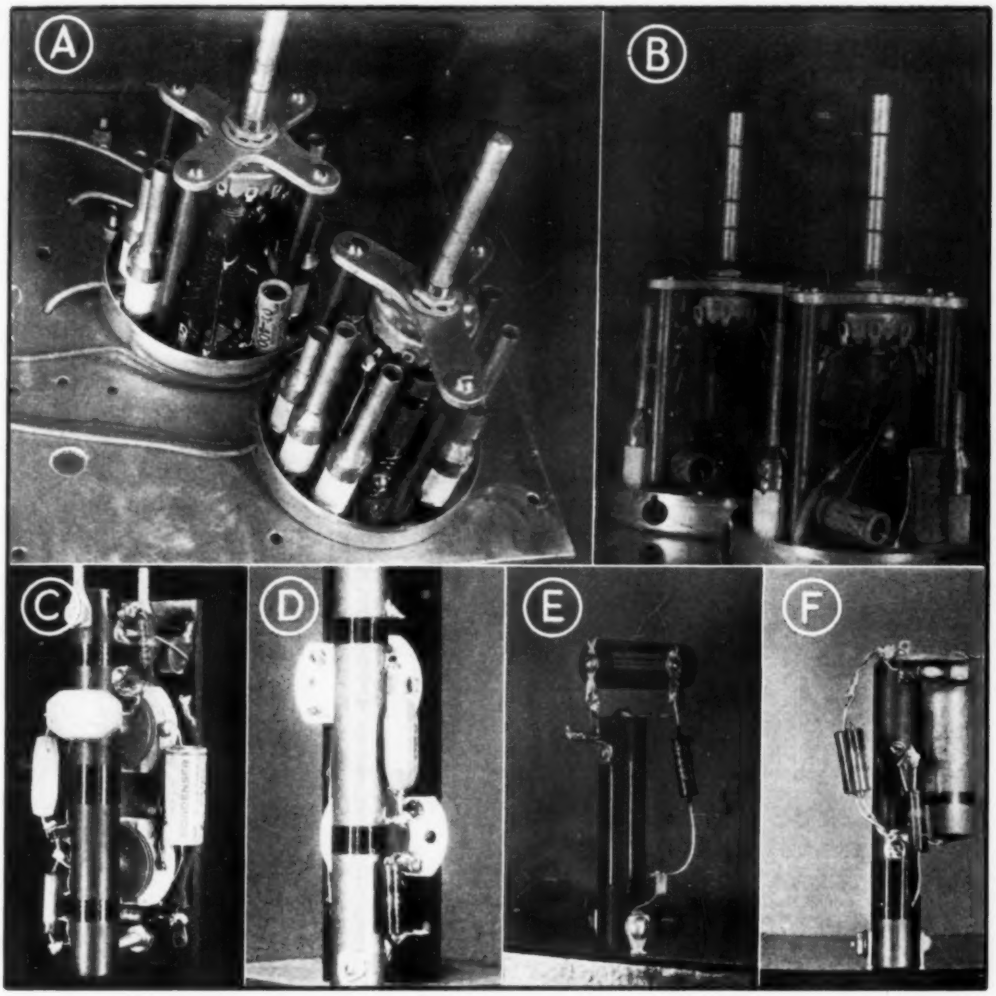


L4 = 5½T. No. 26 ENAMEL
L5 = 5 T. No. 14 ENAMEL
L6 = 5 T. No. 14 ENAMEL
OSCILLATOR-MIXER COIL DESIGN DATA

Fig. 6



TEMPLATE FOR BASE PLATES OF I.F. AND SOUND-BUFFER COIL UNITS



C_{62} (also C_{54}, C_{46}, and C_{30}) is shown in the legend of Fig. 2 as 18 $\mu\mu$fd. If the *actual* value is less than 16.5 to 17 $\mu\mu$fd., the effect is to cut into the 10.5-Mc. end of the i.f. response curve. A value greater than 18.5 to 19 $\mu\mu$fd. will also be detrimental to the band-pass characteristic. Different condensers may be tried if the desired curve cannot otherwise be obtained. The values of the i.f. termination resistors (R_{34}, R_{30}, R_{25}, and R_{20}) are also important, and should not vary from the nominal figure by more than $\pm$ 5 per cent.

For the line-up of i.f. coupling unit No. 3, the grid circuit of V_7 is connected normally, the jumper is removed from the plate circuit of V_6, and the test oscillator is coupled to the grid of V_6 in the same manner as it was to V_7. The v.t. voltmeter is left connected across the detector input circuit for the entire alignment, inasmuch as only overall response curves ordinarily need be taken.

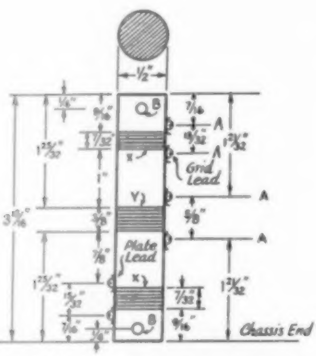
A representative overall curve of i.f. units Nos. 4 and 3 is shown in Fig. 14. The peaks here occur at about 10.5 and 12.5 Mc. This curve is obtained as for i.f. unit No. 4, except that both plate condenser C_{52} and grid condenser C_{55} are adjusted. C_{52} should be used essentially to adjust the low-frequency peak and C_{55} the high-frequency peak, although some effects on both peaks are produced by either adjustment. These effects may be readily checked by tuning the test oscillator fairly rapidly through the proper range and simultaneously observing the rise and fall of the v.t. voltmeter reading. The coupling units are so designed that only a small amount of the capacitance of either condenser should be required. It will be found that the peaks will become more pronounced and more easily checked on the v.t. voltmeter as more cascaded stages are lined up, because the overall curve represents the product of the gains of all the stages in operation.

I.f. unit No. 2 should next be aligned according to the general procedure just described. The jumper across the plate circuit of V_5 should not be forgotten, and must be removed. The test oscillator is coupled to the grid circuit of V_5, using the coaxial line connected as shown in Fig. 12, and condensers C_{44} and C_{47} are adjusted. A typical overall curve for i.f. units Nos. 4, 3, and 2 is shown in Fig. 15.

Before i.f. unit No. 1 is adjusted, it is necessary to align the sound-buffer stage. It has been mentioned that the 1853 sound-buffer tube is used to prevent the oscillator of the sound receiver from feeding into the video i.f. stages, inasmuch as the frequency of the oscillator in the sound receiver is usually close to the video i.f. band. The sound buffer tube is not used for amplification of the sound i.f. signal, but it serves as a coupling tube in addition to its other function. For the alignment, proceed as follows:

Connect the antenna and ground terminals of the sound receiver to the 50-ohm termination (R_{16}) of the sound-buffer transmission line, shown in Fig. 2. Disconnect the sound input lead (coming from the plate circuit of the mixer tube) at R_{13} and connect the free end of R_{13} to the test oscillator, using transmission-line coupling. Set the test oscillator at 11.25 Mc. (with 400-cycle modulation now applied) and tune the sound receiver to this frequency. Adjust C_{33} until the modulated 11.25-Mc. signal is a minimum in the sound receiver. This adjustment should be made at a low output level — that is, with a small oscillator signal and a low receiver volume-control setting — after the signal has once been tuned in. Next, set the oscillator at 9.75 Mc. and tune the sound receiver to this signal. Then adjust C_{35} until the signal is a maximum at a low output level. Repeat the entire procedure once more, starting again with the 11.25-Mc. modulated signal. This

FIG. 7



A = 2-56 × 3/16" BRASS R.H. MACHINE SCREW AND LUG, TAPPED IN
B = TAP THROUGH FOR 6-32 F.H. BRASS MACHINE SCREW
X = 23 T. No. 32 ENAMEL, L_9, L_{11}, L_{12}, L_{14}, ETC.
Y = 46 T. No. 32 ENAMEL, L_{10}, L_{13}, L_{16}, L_{19}
I. F. COIL DESIGN DATA

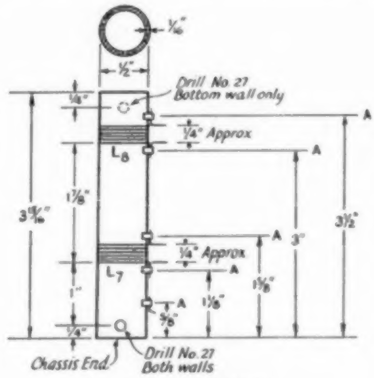


FIG. 8

L_7 = 29 T No. 32 ENAMEL
L_8 = 26 T No. 32 ENAMEL
A = RIVET LUGS, DRILL No. 35
SOUND-BUFFER-COIL DESIGN DATA

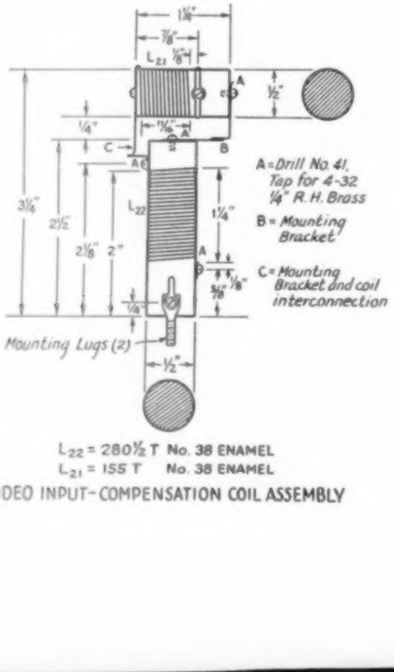


FIG. 9

L_{22} = 280½ T No. 38 ENAMEL
L_{21} = 155 T No. 38 ENAMEL
VIDEO INPUT-COMPENSATION COIL ASSEMBLY

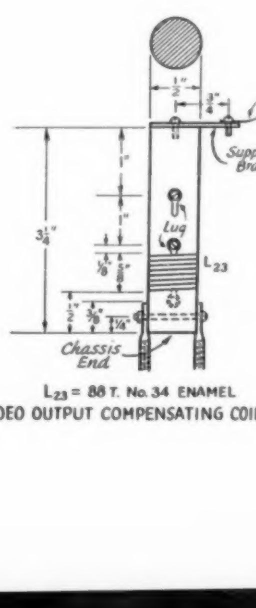


FIG. 10

L_{23} = 88 T. No. 34 ENAMEL
VIDEO OUTPUT COMPENSATING COIL & FORM

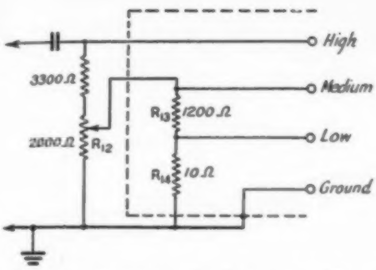


Fig. 11 — Normal output circuit of Type 153 (RCA) test oscillator.

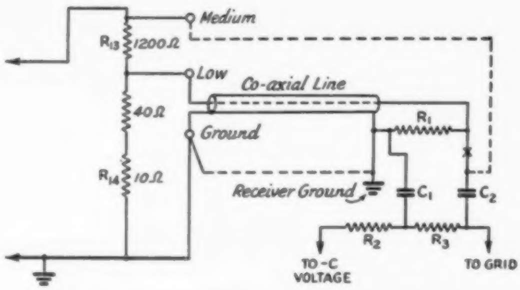
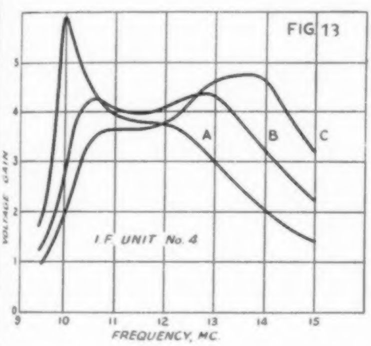


Fig. 12 — Revised oscillator-output circuit and coupling system. The coaxial transmission line is the same material as described for the output of the sound-buffer unit in December *QST*. Values are as follows: R_1, 50 ohms, ½-watt; R_2, R_3, 50,000 ohms, ½-watt; C_1, C_2, 50-μμfd. mica, midget type.

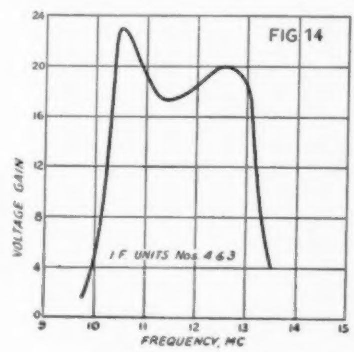
should complete the adjustment of the sound buffer stage, so that its input lead can be reconnected to the mixer plate circuit.

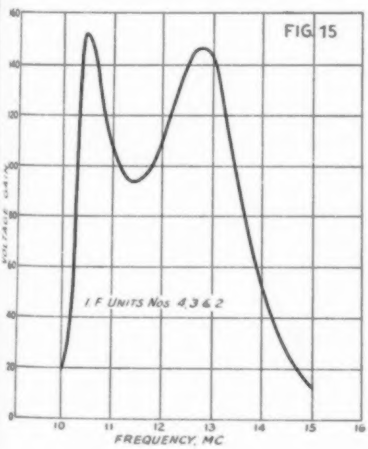
The test oscillator should now be connected to the mixer input and i.f. unit No. 1 aligned, according to the procedure previously described for i.f. unit No. 2. After the proper adjustment of C_{28} and C_{31}, an overall i.f. curve similar to Fig. 16-A should be obtained. The mixer is thus used, for this step of the alignment, as an i.f. amplifier under mixer tube conditions.

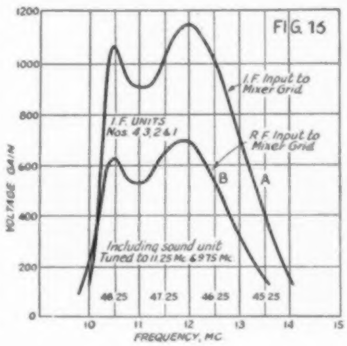
It will be seen that the curve of Fig. 16-A substantially fulfills the requirements for the desired type of i.f. response, according to the theoretical considerations discussed in the preceding article. An effect of the sound buffer stage is to reduce the response variation over the i.f. band and to reduce the i.f. gain in the neighborhood of 13 Mc. This reduction of gain at the high i.f. (low video)

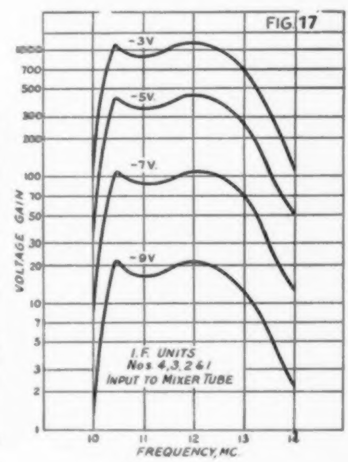


Figs. 13–17 — I.f. response curves at progressive stages in the alignment procedure. Fig. 17 shows the overall i.f. response with different values of grid bias (gain control) applied to the i.f. grids.









end of the video sideband is desirable in order to minimize overlapping of the low video frequencies, as pointed out in December *QST* (see Fig. 1). The tendency for such overlapping or "doubling up" of the low video frequencies is, of course, due in part to the fact that single-sideband reception is employed in the receiver.

The curve of Fig. 16-B gives the overall gain characteristic of the receiver, exclusive of the r.f. and video stages, with r.f. input to the mixer tube used to beat with the inserted oscillator signal. The oscillator frequency for this curve was set at 58.75 Mc.

When the alignment procedure has been completed and the final i.f. response curve has the desired characteristics, the vacuum-tube voltmeter is removed from the detector input circuit. The detector plate condenser C_{63} is reconnected and its rotor meshed about ¼ inch, as measured along the outer edges of the rotor plates. Slight re-settings of C_{63} should be tried after a picture is obtained, to determine if the picture definition can be improved. However, the detector input circuit is sufficiently broad so that the effects of any slight misalignment will be minimized.

G — Photograph of test pattern from an r.f. signal generator on the screen of a Type 1800 Kinescope used with the receiver described.

The four curves of Fig. 17 show the response of the receiver with different values of grid bias on the r.f. and i.f. tubes. In this receiver, the pass band does not vary appreciably with grid bias changes. It will be observed (Fig. 2) that the cathode resistors of the r.f. and i.f. stages are *not* by-passed. The omission of the cathode by-pass condensers tends to minimize input-capacitance variations in the a.g.c. controlled tubes and is an important factor in obtaining the operating characteristics desired of the receiver. The overall i.f. response is practically flat from 10.5 Mc. to 13 Mc., as is shown by the logarithmic gain curves of Fig. 17.

Operation

With the i.f. alignment completed, the picture receiver is ready to be connected to the scanning and Kinescope units. It is important to note that this receiver is especially designed to "tie in" with the electromagnetic Kinescope and scanning units to be described in a subsequent article by Mr. J. B. Sherman. The output terminals shown in Fig. 2 can be directly connected to the electromagnetic units, and the various receiver controls and circuits function just as described.

If, however, one of the electrostatic Kinescope and scanning units shown earlier[4] is to be employed, some variations in procedure are required. In Figs. 3 and 4 (October *QST*) the external connection to the Kinescope grid is marked "Video Input." A 0.5-μfd. d.c. blocking condenser must be inserted in this lead before it is connected to the output terminal of the video amplifier in the picture receiver. With this capacitive coupling, the Kinescope receives its d.c. background-control bias from the Kinescope power pack, as shown in October *QST*, and not from the picture receiver. The receiver terminal marked "To cathode of Kinescope" and bias potentiometer R_{55} (Fig. 2, December *QST*) are thus not used with the electrostatic units. This means, of course, that the automatic background-control circuit in the picture receiver is not put to use, because of the "a.c. coupling" of the video input signal.

After the 0.5-μfd. condenser has been inserted in the Kinescope grid circuit, the picture receiver is connected to the other units as shown in the circuit diagrams, omitting the Kinescope cathode connection at the receiver. The chassis of the various units which go to make up the complete receiver should all be tied together with a good, low-resistance ground strap.

The antenna feeders, assuming a half-wave doublet antenna is used, consist of a twisted pair. The feeder leads are connected to the two antenna terminals provided on the picture receiver chassis. Switches S_1 and S_2 are set in the maximum-capacitance position (on C_3, C_8, C_9 and C_{12}), for a station in the 44–49 Mc. range.

The scanning circuits are put into operation as described in October *QST*, so that the rectangular picture area is scanned.

For locations where a strong signal from the transmitter is available, no particular difficulty should be encountered in tuning in the signal. Usually, an adjustment of the oscillator frequency (by means of C_{12}) will bring in some signal. Once a signal is obtained, the effects of tuning, synchronizing, and the background control will readily be noticed on the Kinescope screen. One of the first steps is to tune the pre-selector and mixer controls until the signal is strong enough to obtain proper synchronization of the scanning oscillators with the transmitter. The background

(Continued on page 116)

[4] J. B. Sherman, "Building Television Receivers with Standard Cathode-Ray Tubes," *QST*, October, 1938.

ARMY-AMATEUR RADIO SYSTEM ACTIVITIES

THE Eighth Corps Area of the Army Amateur Radio System is comprised of the states of Texas, Oklahoma, Colorado, New Mexico, Arizona and a small corner of Wyoming in which is located Fort Francis E. Warren. This is, roughly, a little more than 22 per cent of the entire area of the United States, to be covered by the Corps Area Nets. Headquarters and the Net Control Station are located at Fort Sam Houston, Texas, near San Antonio.

The Eighth has had its share of disastrous emergencies. Hurricanes, floods and even ice storms as late as the winter of 1937–38 have tested the efficiency of the A.A.R.S. and its organization.

The reason so many good amateurs are in favor of traffic handling systems and nets is because these systems provide the necessary training to make an amateur operator an efficient operator. Traffic handling and drill periods make good operators better. Good operators are essential in an emergency because they know what to do more quickly and efficiently than those without training. For the benefit of everyone, amateur radio must be prepared to operate immediately at any given time.

Some good amateur operators hesitate to enroll in the A.A.R.S. for fear they will not have time to fulfill the drill period requirements. While there is no limit to the amount of time a member may devote to A.A.R.S. work, the Eighth Corps Area has defined for its members the minimum weekly requirements. These requirements are as follows:

1. Copy a broadcast from the Army Net Control station, WLM, Washington, D. C., once weekly on Monday nights.
2. Copy a broadcast from the Corps Area Net Control Station, W5OW, Fort Sam Houston, Texas.
3. Prepare a message to the State Net Control Station stating that the two above broadcasts have been copied.
4. Contact by radio the State NCS or his alternate and send him the message that has been prepared.

These four weekly requirements constitute a basis for scoring members under a system similar to baseball batting averages. Each item is a time at bat. Four hits each week give a member a batting average of 1,000. Members not having an abundance of time will find that the minimum may be held to as little as an hour each week if all goes well.

When a member has enrolled he is furnished with a copy of Circular No. 6. This circular is a combination of five pamphlets covering all the details found in drill practice, cryptography, etc. After a two months' probationary period, a member is issued a certificate of membership and enrolled in the active files of his particular State Net.

Normally, all stations in a state operate on the State Net frequency. This is usually in the 80-meter band on c.w., although some nets use phone and the 160-meter band. Drills are normally conducted on Monday nights but may be authorized at other periods of the week. In fact, several nets meet nightly for the exchange of traffic and ideas. The Corps Area Net, conducted by WLJ on 6990 kcs. is open each evening except Sunday and traffic reaching WLJ is expeditiously handled through the Army Net.

The Net Calls and Spot Frequencies of the different states in the Eighth Corps Area are as follows: Colorado (CO) 3840 kc.; New Mexico (NM) 3702.5 kc.; Arizona (AZ) 3597.5 kc.; Oklahoma (OL) 3682.5 kc. and Texas (TX) 3657.5 kc.

The Army Net and Corps Area Net Broadcasts are made on Monday nights at the following times: WLM at 7:00 P.M. and 10:00 P.M. E.S.T., simultaneously on 3497.5 and 6990 kc. W5OW at 6:30 P.M. C.S.T. on 3790 kc. The Corps Area Broadcast is made twice, at 6:30 P.M. and 8:30 P.M. C.S.T. on 3790 kc.

Beginning with the April 1938 issue of *QST*, a cryptogram has appeared at the close of the A.A.R.S. activities article. Several of these have been quite difficult to solve. Eighty persons have submitted solutions as follows: April, 49; May, 23; June, 43; July, 27; August, 10; September, 3 and October, 1.

Following is this month's problem: UABUW WFUZN DUABY DAOZC ATAPT EFVVF EOGDG SDWIH QQWHP IGWIM KUVOA EIKFF JEOAJ MQQGJ JPGBH IZDMP IGXGU WFGCA UMDZW SSOFK EXXXX

Correct solutions submitted to the Liaison Officer, A.A.R.S., 3441 Munitions Bldg., Washington, D. C., will be acknowledged.

Strays

W2KSF has finally found a use for his old variable condensers — he uses them as slicers for hard-boiled eggs!

2nd Annual "A.R.R.L." QSO Party!

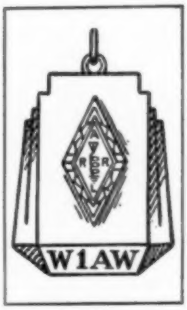
Fun and Fraternalism for Members—January 7th–8th (Sat.-Sun.)—Distinctive Membership Charms with Calls to be Awarded in each Section[1]—Try Your Luck in Get-Acquainted Party for All Members—Start a QSO List, Call "ARRL de . . . ," Use 'Phone or Telegraph, Any Bands in This Activity

MEMBERS in each Section are invited to chat with as many other A.R.R.L. members (anywhere) as they can. The leading member station in each Section will receive *his own call* on the attractive watch charm medallions (illustrated) as soon as results have been analyzed.

Only A.R.R.L. Members are eligible. It is a family party for all of us members, a chance to see who our fraternity brothers are. CQ's are out! The way to get contacts in this will be to send "ARRL de . . ." In the course of a contact members will tell each other two things, the *name* of their Section[1] and the *date* their membership expires, month and year.

Log forms (not necessary) will be sent free on request to Hq., or rule your own, just three columns listing *calls, Sections,*[1] *dates.* In radiotelephone contacts the Section, membership month and year will be named. No special order is required. The exchange can be a small part of the conversation. Radiotelegraph members will abbreviate Section names and use four numerals to show membership dates. "Conn 0343" will mean "Connecticut Section, my membership good until *March 1943*" for example. Information to be exchanged in every case comes right off your own *League membership certificate or pocket card.* Members will not enter in either a radiotelegraph or radiotelephone classification. Many use both. Scores can be all by one mode, or part telegraph and part voice—and any combination of frequencies you like. Advance entry is unnecessary. Just take part and send in the list of members you worked with claimed score.

Starting Time: Saturday, January 7th, 2300 11 P.M. Greenwich; 3 P.M. PST; 4 P.M. MST; 5 P.M. CST; 6 P.M. EST or the equivalent at any point.



Gold-Bronze-Enamelled Medallions with personal calls in the style shown will be awarded in each of the 71 A.R.R.L. sections and to the member leading each of the six continental areas.

Ending Time: Monday, January 9th, 0801 8:01 A.M. Greenwich; 12:01 A.M. PST; 1:01 A.M. MST; 2:01 A.M. CST; 3:01 A.M. EST or equivalent.

Operate *any 20* hours of the 33-hour party. State contest hours you did *not* operate if your score is over 10,000.

Scoring: 1 point for each complete set of information sent; 1 point for each set of data received and logged. No member can be worked to get more than one complete exchange for 2 points. The sum of points will be multiplied by the number of *different Sections* (and continents[2] outside field organization territory) in which at least one member has been worked and exchange effected. A convenient way to keep record of new and different Sections as you work them is to circle and number the name of the Section the first time it is written in your list.

A lot of fun assured. See how many members *you* can work on this January Saturday-Sunday weekend. And if you work anybody not a member, ask him "Why not?" It's one of the big annual events. See you there.

—*F. E. H.*

[1] See complete list of 71 A.R.R.L. field organization Sections, in this issue of *QST*. An insignia award is also available to the leading member in each continent (outside field organization territory). All members outside the field organization use the name of their continent instead of a section abbreviation. Note that CO-CM. K4-6-7, KA, and VO as well as W-VE members are in the field organization and cannot be also counted under a continental status. Hq. staff stations and W1AW will participate but are not eligible for awards.

[2] The multiplier is the sum of the number of Sections and continents outside the field organization territory in which at least one A.R.R.L. member is contacted. But a single multiplier times the sum of points gives the score. Example: W6XXX has completed two-way exchanges with 57 different stations located in 31 different A.R.R.L. Sections and Europe and Oceania. His multiplier is 33. Score? $2 \times 57 = 114$. $114 \times 33 = 3762$.

A Compact Crystal-Controlled 56-28-Mc. 'Phone Transmitter

A 25-Watt Input Band-Switching Unit Adaptable to Fixed-Station or Portable-Mobile Use

BY D. D. KAHLE,* W9AUJ

The "5 and 10" outfit described in this article has some interesting circuit features, both r.f. and audio, besides its physical compactness. With "B" consumption approximately 150 ma. at 350 volts, it can be used with either the familiar a.c. power pack or the battery-operated vibrator-type supply.

WITH the ever increasing activity on the 5- and 10-meter bands, the writer felt that a small transmitter, suitable for both portable mobile and fixed station use and designed for quick changing between 5 and 10 meters, would be welcome to the ultra-high-frequency minded amateur. This unit has been designed with several unusual features, among which are a unique system of band-switching, a high-quality audio system, and a minimum number of parts consistent with good design and compact construction.

R.F. Section

The transmitter is built on a chassis measuring 7 by 7 by 2¾ inches. The r.f. system consists of a 6V6 metal tube as a Tri-tet oscillator, operating from a 20-meter crystal, and an 807 final amplifier. The Tri-tet oscillator is conventional, and the only precaution necessary is that the cathode and output tanks should be well shielded from each other, since the cathode circuit tunes to a frequency fairly close to the output circuit. In the transmitter described, the cathode tuned circuit is mounted above the chassis while the output circuit is underneath. This is advantageous since the fact that the grid of the 807 comes out underneath the chassis makes an extremely short grid lead possible. A 250-milliampere (6.3-volt) pilot lamp in series with the crystal barely glows, showing a low value of crystal current. The plate current of the oscillator is about 25 ma. loaded.

The 807 is used as a straight amplifier on 10 meters or as a doubler for operation on 5 meters. The grid current is about 4 milliamperes, which is slightly more than needed on 10 but is just about the correct value to drive the 807 as a doubler to 5. It is important that an I.R.C. old-style resistor with the metal ends be used in the grid circuit of the 807. Resistors of the new insulated type, both 1- and 2-watt sizes, were tried but apparently the insulation loss at 10 meters is very high, because both heated so badly that the insulation cracked, even with no tube in the final amplifier. Only 2 milliamperes of excitation were obtained with the insulated type whereas 4 milliamperes are obtained with the old metal-ended type. Ceramic material is used for insulation in the old type but the material in the new insulated type is evidently very poor for high-frequency use. Any resistor using ceramic insulation should operate satisfactorily.[1]

The 807 socket is extended below the top of the chassis so that the overall height of the unit with the 807 in the socket is 6¾ inches. This allows the transmitter to be mounted in a standard 7-by-8-by-8 cabinet. A large hole is cut in the chassis to enable the shield, which is mounted on the socket, to extend above the chassis.

A novel system of band-switching was designed for simplicity. As shown in the diagram, a single coil, condenser and 2-gang isolantite-insulated

*571 Lafayette St., Denver, Colo.

[1] A good r.f. choke in series with the leak would prevent loss of this sort, since without the choke the resistor must carry r.f. as well as d.c. The insulated-type resistors have larger capacity in addition to the bakelite casing; both factors contribute to the greater loss as compared to the older type.—EDITOR.

Compact construction features this crystal-controlled 28–56-Mc. transmitter. The case contains two-stage r.f. and three-stage audio systems. The r.f. output tube is an 807.

switch are used in the tank circuit. In an attempt to improve the efficiency of the 56-megacycle tank circuit, series tuning was chosen. Since the output capacity of the tube and capacity of wiring, etc., is practically all the capacity needed for a tank circuit of proper *LC* ratio for 5 meters, the addition of any external parallel capacity results in high circulating current. Because of skin effect and higher resistance at ultra-high frequencies, this high current results in reduced power output. With series tuning, we eliminate the disadvantage of additional parallel capacity and allow the circulating current to flow through the plate and screen leads of the tube. Since the 807 is designed for maximum input at 60 megacycles, it is able to withstand these circulating currents through

The top-of-chassis layout. The final tank circuit is at the left, next to the 807 tube. Oscillator and cathode tank circuit occupy the right foreground. The small can just behind the crystal is the microphone battery case. Audio section is along the rear edge.

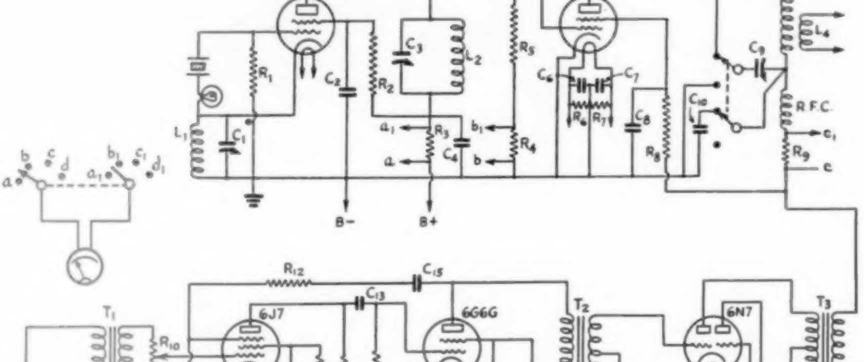


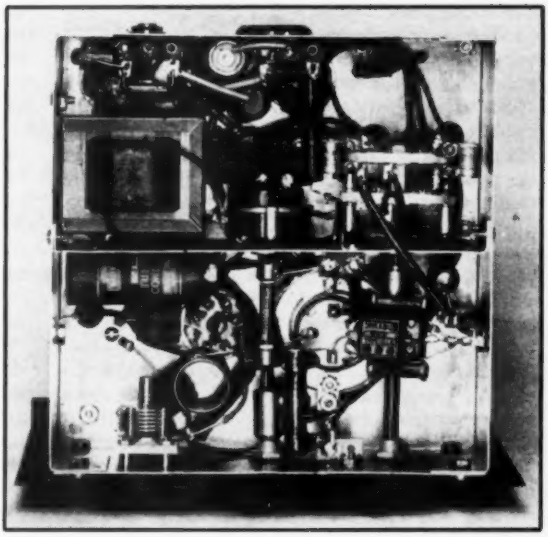
Fig. 1 — Circuit diagram of the r.f. and audio sections.

R_1 — 100,000-ohm, ½-watt. R_2 — 30,000-ohm, 1-watt.
R_3 — Meter shunt. R_4 — 600 ohms (meter shunt).
R_5 — 50,000-ohm, 1-watt (I.R.C. Type F).
R_6, R_7 — 50-ohm, ½-watt.
R_8 — 10,000-ohm, 10-watt. R_9 — Meter shunt.
R_{10} — 500,000-ohm potentiometer.
R_{11} — 600-ohm, ½-watt. R_{12} — 50,000-ohm, ½-watt.
R_{13} — 500,000-ohm, ½-watt.
R_{14} — 100,000-ohm, ½-watt.
R_{15} — 500,000-ohm, ½-watt. R_{16} — 600-ohm, ½-watt.
R_{17} — 75,000-ohm, 1-watt.
R_{18} — 12,500-ohm, 2-watt. R_{19} — Meter shunt.
C_1 — 75-$\mu\mu$fd. midget variable (National UM-75).
C_2 — 0.002-μfd. mica.
C_3 — 35-$\mu\mu$fd. midget variable (National UM-35).
C_4 — 0.001-μfd. mica. C_6, C_7 — 0.001-μfd. mica.
C_5 — 75-$\mu\mu$fd. mica. C_8 — 0.002-μfd. mica.
C_9 — 25-$\mu\mu$fd. midget, double spaced (National UM-100 rebuilt; alternate plates removed).
C_{10} — 0.002-μfd. mica.
C_{11} — See text.
C_{12}, C_{13} — 0.1-μfd. paper, 450-volt.
C_{14} — 25-μfd. electrolytic, 25-volt.
C_{15}, C_{16} — 0.1-μfd. paper, 450-volt.
C_{17} — 0.5-μfd., 450-volt.
T_1 — S.B. microphone transformer (Thordarson T-86A02).
T_2 — Class-B input transformer for 6N7 (Thordarson T-67D89).
T_3 — Class-B output transformer, 10,000 to 3500/5000 ohms (U.T.C. CS-33).
RFC — 2.5-mh. r.f. choke.
L_1 — 9 turns No. 12, inside diameter ¾ inch, turns spaced slightly less than wire diameter.
L_2 — 8 turns same as L_1.
L_3 — Same as L_1.
L_4 — 3 turns No. 16, covered with spaghetti tubing.

the leads.[2] Although the tube efficiency may not be increased, the actual tank efficiency is undoubtedly increased.

For 10-meter operation, the condenser is switched in parallel with the coil, and a by-pass condenser is switched in from the "B"-plus side of the tank coil to ground. This arrangement results in a tank circuit of proper *LC* ratio for 10 meters. It is now seen that 5- to 10-meter band-switching is accomplished without any loss of efficiency, and it is highly probable that some efficiency is gained through the use of series tuning on 5 meters.

The tank condenser, 25-$\mu\mu$fd. maximum capacity, tunes about three-fourths of the way in on 10 and one-fourth in on 5, using the same crystal. The plate current of the 807 at resonance, unloaded, on 10 meters is 8 ma. with 360 volts on the plate. On 56 Mc. it is about 22 ma. with the same plate voltage. The minimum plate current unloaded, however, is not a true indication of efficiency; the figures are given simply as a comparative value on which the amateur can base his own findings.



Bottom view, showing the division between r.f. and audio. In the lower (r.f.) section, the oscillator output tank circuit is at the left; 807 socket at the right. The meter switch and gain control are in the audio section, mounted on the shield partition. They are operated by extension shafts from the panel.

Audio Equipment

The speech amplifier and modulator were designed with the idea in mind of obtaining the best quality possible with standard parts. Two stages of speech amplification were used so that sufficient gain would be available for fixed station operation. The 6J7 pentode feeds a 6G6G pentode driver for a 6N7 modulator. A large amount of negative feed-back is used from the plate of the 6G6G to the cathode of the 6J7 to reduce distortion which develops in the pentode driver stage. The use of negative feed-back also cancels most of the hum in the first two stages and reduces the overall gain to a usable value for carbon-microphone operation. No decoupling filter is necessary in the 6J7 plate circuit. A 50- or 100-$\mu\mu$fd. fixed condenser from cathode to ground in the 6J7 stage may be necessary to prevent r.f. feedback in the audio system, although it was not used in the original model. The 12,500-ohm 2-watt resistor is used to drop the plate voltage of the 6G6G to 180 volts. The 6G6G was chosen as a driver principally because of its better driving capabilities and lower heater current.

With the assistance of W9CJJ of KFEL, a complete test was made on the audio system. The results were surprising indeed. The unweighted noise level measured − 44 db. The overall response from the grid of the 6J7 to the secondary of the modulation transformer, measured from zero level at 1000 cycles, was found to be flat within 2 db from 50 to 12,000 cycles. The total harmonic distortion measured 9 per cent at 20 watts input to the final amplifier with 100 per cent modulation.

It may seem strange that a single-button microphone is used after all the talk about the high-quality audio system, but the microphone used is a telephone type F-1 which has excellent quality for a carbon microphone. However, the idea in mind in giving information on response, noise level and distortion is to show what can be obtained from standard low-priced components, negative feed-back and proper design. The type F-1 microphone, however, sounds very good on

[2] At least at the plate voltage used by the author. A good by-pass condenser must be used from screen to ground, and the lead from the switch to the ground side of the condenser made direct and short.—EDITOR.

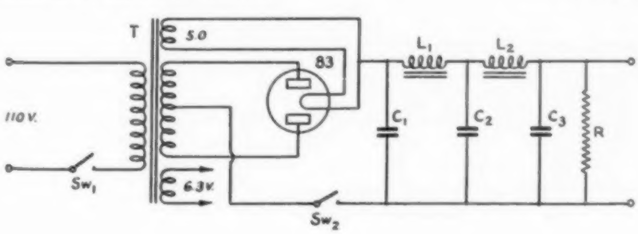


Fig. 2 — Power supply circuit.
T — Power transformer, 350v. each side c.t., 145 ma., with 5- and 6.3-volt filament windings (Thordarson T-70R62.)
C_1, C_2, C_3 — 8-μfd. electrolytic, 500-volt.
L_1, L_2 — 8-henry, 150-ma. (Thordarson T-13C30).
R — 25,000-ohm, 25-watt.
Sw_1, Sw_2 — S.p.s.t. toggle switches.

the air. A used button will not sound nearly as good as a new one, as those which have been in telephone service have been operated above 1.5 volts and in a good many cases the carbon is "frozen." Operating these buttons at 1.5 volts improves the frequency response because of the reduced current (about 10 milliamperes) through the primary of the input transformer. These buttons are now available from the Western Electric Company at a cost of $4.50. Since they operate at such low current, a standard 1.5-volt flashlight cell can be used to supply current to them.

The round object next to the Thordarson modulator-input transformer is the microphone battery case. It was made of two pieces of 1/16-inch wall brass tubing. The plug-in part consists of a piece of 1¼-inch inside diameter by 2½-inch long tubing, with a spiral flashlight spring soldered to a piece of brass plate and the plate in turn soldered to the tubing; after soldering, the excess material is turned off in a lathe. A hole is cut in the chassis, and a piece of bakelite with a brass machine screw filed off flat and inserted in it is mounted underneath the chassis. This screw acts as the positive terminal for the battery. A piece of 1⅜-inch inside diameter tubing is cut three-fourths of an inch long and two spade lugs for mounting are soldered on the inside. This piece of tubing is drilled and tapped for a 6/32 screw and the case countersunk for this screw. The battery is inserted in the case and then slipped into the larger ring which is mounted on the chassis and the screw tightened, holding the battery and case firmly in place. The case can be chromium-plated for about 50 cents. The head of the holding screw comes out on the side of the chassis, and a hole is drilled in the cabinet so the battery can be removed without taking the chassis from the cabinet.

The microphone "on-off" switch is incorporated on the gain control.

For crystal microphone operation, it is necessary that a pentode stage of preamplification such as a 6J7 be added. The microphone battery case and transformer should be removed to make room for the tube, resistors and condensers. The rest of the amplifier need not be changed. Negative feed-back is not necessary on the preamplifier stage as distortion should be very low. The additional parts for a preamplifier stage will not cost any more than the battery case and transformer and it would probably be well worth while to use a crystal microphone if the transmitter is to be used for fixed station operation most of the time.

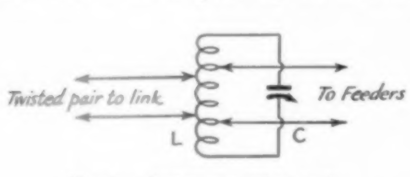


Fig. 3 — Antenna tuning unit.

L — 4 turns No. 12, diameter 1¾ inches, spaced ½ inch.
C — 50-$\mu\mu$fd. variable.

Power Supply and Metering

The entire unit is operated from a 150-milliampere 350-volt supply for fixed station operation. Although most amateurs have such a power supply or the parts for one lying around, the circuit diagram and list of parts is given in Fig. 2 for those who would have to purchase one. The regulation is excellent considering that at 25 watts input to the final, 100 per cent speech modulation does not kick the plate-current meter downward. At 22 watts input, the plate voltage drops to 330 volts and the plate current is about 66 ma. This input presents a load impedance of 5000 ohms to the modulator.

A vibrator supply can be made up for portable-mobile operation by using two 75-milliampere 300-volt units in parallel. The heater drain of the transmitter is 2.6 amperes.

The oscillator plate, final grid, final plate, and modulator plate currents are measured by means of a 10-milliampere meter and a 2-circuit 4-position switch. The shunts are made by buying one Mallory-Electrad 10-watt, 2-ohm wire wound resistor and 4 extra clips. Three 100-milliampere shunts can be made from one resistor and soldered across the switch terminals. It is very easy to make these shunts. The ceramic tubing on which the resistance wire is wound can be broken very easily with a pair of side cutters and the clips put on and adjusted with a standard 100-ma. meter so that the 10-mil meter will read about 95 ma. with the standard reading full scale. Then the resistance wire can be filed off until 100-milliampere full scale reading is obtained. This system is practically as cheap as the plug and jack system and is much more convenient.

A 500-ohm resistor is connected across the switch terminals measuring the grid current. This resistor across the 10-milliampere movement does not affect the meter reading and, of course, the meter being shunted across it does not affect the grid current to the final.

Antenna Coupling

For fixed station operation, link coupling is used to an antenna coupling system. Fig. 3 shows the diagram. This coupling system is very simple and allows either tuned or untuned feeders of any impedance to be matched to the transmitter. Voltage-fed feeders are usually connected near the ends of the coil while current-fed feeders are connected closer to the center. By adjusting the position of the clips on the twisted-pair line, any degree of coupling can be accomplished. This system is usually correctly tuned when the final tank condenser tunes to resonance in the same place loaded as it does unloaded. Care must be taken to keep the clips in the same electrical

position on each side of the center of the coil. If tuned feeders are used on an antenna for 5 and 10 meters, and if they are voltage fed on both bands, then it is possible that no change in the adjustment of the clips will be necessary and only the condenser need be retuned. For portable mobile operation, a better coupling arrangement would be had by tapping on the tank coil with a single-wire feeder.

The pictures show fairly well the parts placement and it is suggested that the constructional design be followed closely to insure efficient operation. No trouble should be experienced provided the circuit constants are duplicated. This unit operated exactly like the preceding "haywire" model with the exception of the r.f. feed-back as mentioned above. All ground and by-pass connections should be as short as possible, and in the r.f. stages should be made to the same point in each stage wherever convenient. It will be a simple, foolproof transmitter and with a reasonably good antenna will provide many reliable contacts.

Dual-Frequency Calibrator

(Continued from page 41)

quency can be estimated or, if desired, compared with some standard such as an audio-frequency oscillator, a piano or a mouth-organ.

The edges of the new 160-meter band and the 20-meter 'phone band are not multiples of 100 kc. They can be determined closely by interpolation, however, or with a strong signal, by performing the measurement at the second harmonic (1750 kc. × 2 = 3500 kc., 2050 kc. × 2 = 4100 kc.).

Images in Superhet Receivers

Other than the necessity for always starting with some known harmonic, there is an additional precaution which must be observed when the calibrator is used in conjunction with a superheterodyne receiver. Misleading calibrations or measurements can result from the presence of images. Unless the images are recognized and ignored, the calibration or measurement will be in error. Suppose we want to locate 7000 kc. with a 1000-kc. harmonic and the receiver i.f. is 465 kc. If the selectivity of the receiver is not extremely high, the 7000-kc. frequency will apparently occur at two points close together. One is correct, the other is an image of 8000 kc.

When the receiver is tuned to 7000 kc. the local oscillator is at 7465 kc. Now if the receiver is tuned to 6070 kc., the 7000-kc. signal may beat with the oscillator to produce the i.f. at 465 kc. and the same signal will be heard again at 6070 kc. (7000 kc. − (6070 kc. + 465 kc.) = 465 kc.). Similarly, the image of the 8000-kc. harmonic will appear at 7070 kc. Therefore, signals may be heard at 7000 kc. and 7070 kc., with 7070 kc., the image, being the weaker of the two. This is not too confusing with 1000-kc. harmonics but could be quite difficult with 100-kc. harmonics because of their closer spacing. With a 465-kc. i.f. and 100-kc. harmonics there would be an image 70 kc. above (or 30 kc. below) each calibration point. Fortunately, however, the natural attenuation of the 100-kc. harmonics with increasing frequency is sufficiently great so that, in most cases, the images are barely discernible.

The problem of images becomes more serious as the frequency is increased because the frequency difference between the image and the correct frequency becomes a smaller percentage and, therefore, the receiver selectivity to images becomes less. By careful observation, with the knowledge that images may be present, incorrect measurements will be avoided. Once the images are recognized, their presence will cause no great concern.

The various controls for the crystal calibrator were designed to provide flexibility so that the instrument can be placed on the operating table and permanently connected to the station receiver. In addition to its application for frequency measurement and checking, the calibrator can be used to indicate dead spots or low sensitivity areas in any one tuning range or seriously decreased sensitivity from one range to another. After the mechanics and technique of using the calibrator have been learned, the instrument will prove to be a valuable adjunct to any amateur station.

810

(Continued on page 19)

Below are given some of the manufacturer's data: Direct interelectrode capacities:

Grid-plate	4.8 μμfd.
Grid-filament	8.7 μμfd.
Plate-filament	12 μμfd.

Class-C telegraphy at maximum plate voltage:

D.c. plate voltage	2000 volts
D.c. grid voltage	−160 volts
Peak r.f. grid voltage	330 volts
D.c. plate current	250 ma.
D.c. grid current	40 ma.
Driving power, approximate	12 watts
Power output, approximate	375 watts

— *T. M. F.*

Strays

A lady to whom W2GVZ recently delivered a ham message wrote a note of thanks and included, "I have a son in California who was an amateur once, but now is earning a nice salary and has his own home."

Cheer up, hams!!

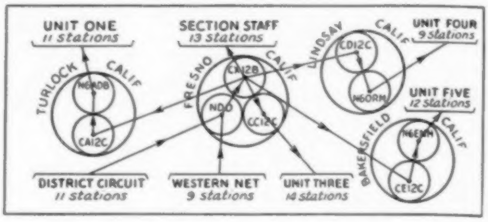
NAVAL COMMUNICATION RESERVE NOTES

Twelfth Naval District, U. S. Naval Communication Reserve

BY LIEUT. (JG) RALPH A. JACK, N6FPW

THE U. S. Naval Communication Reserve of the Twelfth Naval District, commanded by Lieutenant-Commander Henry U. Linkins C-V(S) USNR, has headquarters at 105 Market Street, San Francisco, Calif. Naval Reserve Radio Control station NDH is at NCR headquarters. NDO, the Reserve alternate control station, is located at Fresno, Calif. The District is divided into ten Communication Reserve Sections and 32 units. Sections average about 20,000 square miles and contain several units. The distances between Section District and Unit headquarters are on an average about 60 miles. The distance makes the radio work more interesting and simulates real communication situations where contacts must be solely by radio. NCR Section headquarters are at San Francisco, Oakland, San Mateo, Fresno, Berkeley, Santa Rosa, and Marysville, Calif., and Elko, Nev., Salt Lake, Utah, and Denver, Colo.

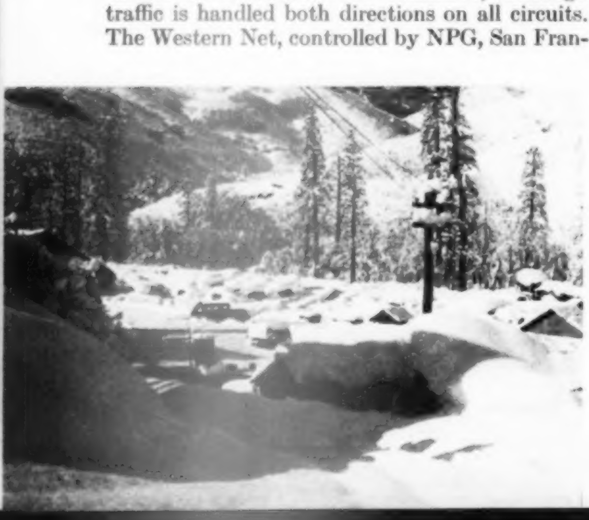
Section Three, the San Joaquin Valley Section, has been selected as a typical example of the NCR sections and is described in this article. Headquarters are in the Naval Reserve Building at the Fresno Municipal Airport. The Section contains four units located respectively at Turlock, Fresno, Lindsay and Bakersfield, as well as the Section headquarters at Fresno. Units One, Four and Five are respectively 90, 65 and 100 miles from the Section headquarters. The diagram shows the radio circuits operating into and out of the Naval Reserve Building in Fresno. The arrows show direction of command, although traffic is handled both directions on all circuits. The Western Net, controlled by NPG, San Francisco, extends from Honolulu to Seattle and San Diego. The District Circuit, controlled by NDH, San Francisco, reaches from San Francisco to the four states, California, Nevada, Utah, and Colorado. Section Three participates in these circuits through NDO on the Western Net and CX12B on the District Circuit. Circuits confined to Section Three are the Section Circuit from Fresno to the four-unit headquarters at Turlock, Fresno, Lindsay and Bakersfield, and the unit circuits. The units each maintain two control or guard transmitters. One of these is on the Section circuit and the other is the unit control station. The unit control station contacts the individual radio stations of the members of the unit. Each unit conducts its own drill on its own frequency. Drills usually last two hours and are held weekly. For approximately 30 minutes Navy Radio NPG broadcasts naval reserve information to all members of the District. By means of the circuit plan it is possible to send information or dispatches from the District headquarters to any reservist at his own radio station in his home and receive answers via the other circuits in a short time. All communication is done on c.w.



The circuits of Section Three NCR. The large circle in the center indicating Fresno is the same as the picture of the radio stations.

The references made to stations and radiomen are made in their amateur station calls, although each radioman also has a Naval Reserve call assigned him for use on Navy frequencies. Each unit has several men enlisted as seamen who are training to become either radiomen or signalmen. This offers an excellent chance for young men who want to develop into radiomen or signalmen. They are given free training. Qualified radiomen are enlisted in rates as radiomen. Inquiries should be addressed to U. S. Naval Communication Reserve Commander, 105 Market Street, San Francisco, Calif.

Two interesting phases of the NCR work are the training duty at sea and at the Naval Reserve Aviation Bases, and the Emergency Com-



The site of emergency communications by N6DXG, N6ENA, N6FPW and N6GBT during snow disasters marooning several hundred people in the Sierra Mountains.

munication services rendered in cases of local disasters. Many radiomen train annually as radiomen on ships of the U. S. Navy at sea, or as radiomen in planes of the U. S. Navy operating out of Naval Reserve Aviation Bases. Section Three radiomen have cruised to Alaska, China, Hawaii, Panama, Mexico, South America, as well as the coastwise cruises. As this is being written, a Unit Three yeoman is on his way to Honolulu on NCR training duty.

One of the most fascinating branches of the work is the emergency communication service which is performed whenever disaster strikes. Many articles have appeared in *QST* about this type of service, so only a summary is given here of the emergency services performed by Section Three during the last few years. Unit Five, Bakersfield, furnished the emergency communications needed for six days when a cloudburst derailed and buried a portion of a train in the Tehachapi Mountains. Unit Three provided emergency communications when a California State Prison Camp was cut off from the outside world for weeks by exceptionally heavy snows. Radiomen N6DXG, N6ENA, N6GBT, N6CLB and N6FPW furnished communications continuously until roads were reopened and 'phone lines up again. The same combination handled emergency communication service when it was necessary to relay word back to snowplow crews to open a little used road, covered with 12 feet of snow at Hume Lake, so a woman could be removed to a hospital in Fresno, 70 miles away, for an emergency appendicitis operation. By use of NCR radio circuits, word reached the California State Highway Camp, isolated by snow and with 'phone lines down. Roads were opened and the woman was brought out and the operation performed successfully all within eight hours.

All units have aided in Flood Emergency communication work. Unit Three and the Section Staff were called upon twice last winter for such service. Members of Section Three Staff and of Unit Three spent 82 hours in the air in searching planes last spring, flying over snow-covered

N6GBT in rear cockpit ready for flight as radioman in U. S. Navy plane.

This shows the Section Three headquarters radio room at the Fresno Airport. Transmitters operating on district, section and unit circuits are shown: Left to right, CX12B, NDO, CC12C, Supervisor N6CXM, Radiomen. Back row: N6NWN, N6IBU, N6GUR; Front row: N6JDU, N6JHM, N6BRU.

mountains, searching for a lost airliner, passengers and crew.

The U. S. Naval Communication Reserve offers amateurs an opportunity to communicate on circuits that really perform, an opportunity to become proficient in radio communication work, training duty as radiomen at sea with the U. S. Fleet, training duty in the air as radiomen in the planes of the Naval Air Bases, a chance to be a part of an efficient emergency disaster communication system and a rating in the Naval Reserve that is recognized by the U. S. Navy. The Naval Communication Reserve serves the amateur as a large Radio Club with a local chapter in his home town and chapters in most of the cities of the United States. The Club is the amateur's dream of the "Club with its own radio station, circuits, club house and real operators as members."

Book Review

Electrolytic Capacitors, by Paul McKnight Deeley; 276 pages, profusely illustrated. Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Written in a most readable manner by the chief engineer of the Electrolytic Division of Cornell-Dubilier Electric Corp., *Electrolytic Capacitors* constitutes the first treatment of the subject which may be called complete.

While it does not divulge details of processing which might be termed "trade secrets," it is, nevertheless, an excellent source of technical information on the theory, construction, characteristics, testing and application of electrolytic capacitors of all types. Numerous block drawings and charts are used to illustrate the various steps in fabrication and to demonstrate the influence of each of the many factors involved.

The book concludes with an appendix describing the construction of simplified measuring and testing equipment.

—*D. H. M.*

★ I. A. R. U. NEWS ★

Devoted to the interests and activities of the

INTERNATIONAL AMATEUR RADIO UNION

Headquarters Society: THE AMERICAN RADIO RELAY LEAGUE, West Hartford, Conn.

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日本アマチュア無線聯盟 Japan
Liga Colombiana de Radio Aficionados
Liga Mexicana de Radio Experimentadores
Magyar Rövidhullámu Amatőrök Országos Egyesülete
Nederlandsche Vereeniging voor Internationaal Radioamateurisme
Nederlandsch-Indische Vereeniging Voor Internationaal Radioamateurisme
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New Zealand Association of Radio Transmitters
Norsk Radio Relæ Liga
Polski Zwiasek Krotkofalowcow
Radio Club de Cuba
Radio Club Venezolano
Radio Society of Great Britain
Rede dos Emissores Portugueses
Reseau des Emetteurs Français
Reseau Luxembourgeois des Amateurs d'Ondes Courtes
South African Radio Relay League
Suomen Radioamatööriliitto r.y.
Sveriges Sandareamatorer
Unión de Radioemisores Españoles
Union Schweiz Kurzwellen Amateure
Wireless Institute of Australia

COUNTRIES

We are again running the list of countries used in computing the DX Century Club standings. The changes have been few and minor, amounting to the addition of several Pacific island groups (see last month's "How's DX?"), the consolidation of the British New Hebrides and French New Hebrides under one head (after it was determined that whether a French or English call is signed depends solely on the nationality of the operator!), and the deletion of Austria. Austria still counts, of course, under Rule 6 of the Club rules.

Country	*Prefix*
Aden	
Aegean Islands	
Afghanistan	YA
Alaska	K7
Albania	ZA
Aldabra Islands	
Algeria	FA
Andaman Islands	
Andorra	
Anglo-Egyptian Sudan	ST
Angola	CR6
Argentina	LU
Ascension Island	ZD8
Australia	VK
Azores Islands	CT2
Bahama Islands	VP7
Bahrein Islands	VS8
Baker Island, Howland Island, Am. Phoenix Islands	KF6
Balearic Islands	EA6
Baluchistan	
Barbados	VP6
Bechuanaland	
Belgian Congo	OQ
Belgium	ON
Bermuda Islands	VP9
Bhutan	
Bolivia	CP
Borneo, Netherlands	PK5
Brazil	PY
British Honduras	VP1

Country	*Prefix*
British North Borneo	VS4
Brunei	
Bulgaria	LZ
Burma	XZ
Cameroons, French	FE8
Canada	VE
Canal Zone	(K5)
Canary Islands	EA8
Cape Verde Islands	CR4
Caroline Islands	
Cayman Islands	VP5
Celebes and Molucca Islands	PK6
Ceylon	VS7
Chagos Islands	VQ8
Channel Islands	G
Chile	CE
China	XU
Chosen (Korea)	J8
Christmas Island	ZC3
Clipperton Island	
Cocos Island	TI
Cocos Islands	ZC2
Colombia	HJ
Comoro Islands	
Cook Islands	ZK1
Corsica	
Costa Rica	TI
Crete	SV
Cuba	CM-CO
Cyprus	ZC4
Czechoslovakia	OK
Danzig	YM
Denmark	OZ
Dominican Republic	HI
Easter Island	
Ecuador	HC
Egypt	SU
England	G
Eritrea	
Estonia	ES
Ethiopia	ET
Faeroes, The	OY
Falkland Islands	VP8
Fanning Island	VR3
Federated Malay States	VS2
Fiji Islands	VR2
Finland	OH
France	F
French Equatorial Africa	FQ8
French India	FN
French Indochina	FI8
French Oceania	FO8
French West Africa	FF8

Country	Prefix
Fridtjof Nansen Land (Franz Josef Land)	
Galapagos Islands	
Gambia	ZD3
Germany	D
Gibraltar	ZB2
Gilbert & Ellice Islands and Ocean Island	VR1
Goa (Portuguese India)	CR8
Gold Coast (and British Togoland)	ZD4
Gough Island	
Greece	SV
Greenland	OX
Guadeloupe	FG8
Guam	KB6
Guatemala	TG
Guiana, British	VP3
Guiana, Netherlands (Surinam)	PZ
Guiana, French, and Inini	FY8
Guinea, Portuguese	CR5
Guinea, Spanish	
Haiti	HH
Hawaiian Islands	K6
Hejaz	HZ
Honduras	HR
Hong Kong	VS6
Hungary	HA
Iceland	TF
Ifni	
India	VU
Iran (Persia)	EP
Iraq (Mesopotamia)	YI
Ireland, Northern	GI
Irish Free State	EI
Isle of Man	G
Italy	I
Jamaica	VP5
Jan Mayen Island	OY
Japan	J
Jarvis Island, Palmyra group	KG6
Java	PK
Johnston Island	KE6
Kenya	VQ4
Kerguelen Islands	
Kuweit	
Laccadive Islands	
Latvia	YL
Leeward Islands	VP2
Liberia	EL
Libya	
Liechtenstein	
Lithuania	LY
Luxembourg	LX
Macau	CR9
Madagascar	FB8
Madeira Islands	CT3
Maldive Islands	VS9
Malta	ZB1
Manchukuo	(MX)
Marianas Islands	
Marshall Islands	J9
Martinique	FM8
Mauritius	VQ8
Mexico	XE
Midway Island	KD6
Miquelon and St. Pierre Islands	FP8
Monaco	
Mongolia	
Morocco, French	CN
Morocco, Spanish	EA9
Mozambique	CR7
Nepal	
Netherlands	PA
Netherlands West Indies (Curacao)	PJ
New Caledonia	FK8
Newfoundland and Labrador	VO
New Guinea, Netherlands	PK6
New Guinea, Territory of	VK9
New Hebrides	FU8, YJ
New Zealand	ZL
Nicaragua	YN
Nicobar Islands	
Nigeria (British Cameroons)	ZD2
Niue	ZK2
Non-Federated Malay States	VS3
Norway	LA
Nyasaland	ZD6

Country	Prefix
Oman	
Palau (Pelew) Islands	
Palestine	ZC6
Panama	HP
Papua Territory	VK4
Paraguay	ZP
Peru	OA
Philippine Islands	KA
Phoenix Islands	
Pitcairn Island	VR6
Poland	SP
Portugal	CT
Principe and Sao Thome Islands	
Puerto Rico	K4
Reunion Island	FR8
Rhodesia, Northern	VQ2
Rhodesia, Southern	ZE
Rio de Oro	
Roumania	YR
St. Helena	ZD7
Salvador	YS
Sardinia	
Samoa, American	KH
Samoa, Western	ZM
Sarawak	VS5
Saudi Arabia	
Scotland	GM
Seychelles	VQ9
Siam	HS
Sierra Leone	ZD1
Socotra	
Solomon Islands	VR4
Somaliland, British	VQ6
Somaliland, French	FL8
Somaliland, Italian	
South Georgia	VP8
South Orkney Islands	VP8
South Shetland Islands	VP8
Southwest Africa	ZS3
Soviet Union:	
European Russian Socialist Federated Soviet Republic	U1–3–4 7
White Russian Soviet Socialist Republic	U2
Ukranian Soviet Socialist Republic	U5
Transcaucasian Socialist Federal Soviet Republic	U6
Uzbek Soviet Socialist Republic (Uzbekistan)	U8
Turkoman Soviet Socialist Republic	U8
Asiatic Russian S.F.S.R.	U9–0
Spain	EA
Straits Settlements	VS1
Sumatra	PK4
Svalbard (Spitzbergen)	
Sweden	SM
Switzerland	HB
Syria	
Taiwan (Formosa)	J9
Tanganyika Territory	VQ3
Tangier Zone	
Tannu Tuva	
Tasmania	VK7
Tibet	
Timor, Portuguese	CR10
Togoland, French	FD8
Tokelau (Union) Islands	
Tonga (Friendly) Islands	VR5
Transjordan	ZC1
Trinidad and Tobago	VP4
Tristan da Cunha	ZU9
Tunisia	FT4
Turkey	TA
Turks and Caicos Islands	VP5
Uganda	VQ5
Union of South Africa	ZS
United States	W [N]
Uruguay	CX
Venezuela	YV
Virgin Islands	KB4
Wake group	KC6
Wales	GW
Windward Islands	VP2
Wrangel Island	
Yemen	
Yugoslavia	YT-YU
Zanzibar	VQ1

A Signal-Metering Valve

A Different Approach to the Limitation of Signals and Noise Peaks in Receivers

BY H. O. TALEN,* W9PYQ

A VARIETY of methods has been developed for limiting the signal and noise peaks which blare out of our loudspeakers and earphones so unexpectedly at times. Some of the devices are applicable to the intermediate frequency channel in a superheterodyne receiver, others to the detector or audio channel, but very few to the high-frequency circuits in the receiver.

The circuit arrangement to be described is one which was evolved during a series of experiments with a 14-Mc. receiver of the tuned r.f.-regenerative detector type. It has not been tried out here in a superheterodyne line-up as yet.

The Problem

Automobile sparks, static and heavily modulated carriers have a natural but disconcerting way of getting into and through the first tuned circuits of the receiver. Fading signals, especially those which "fade in" to an R9++ are equally distressing with a receiver which has little or no automatic gain control action.

It has previously been pointed out by J. J. Lamb that the limitation of signal and noise peaks should take place in the earlier circuits in the receiver, before the high-Q tuned circuits are reached.[1] The difficulty involved depends primarily upon the insensitivity and relatively slow response of the majority of limiting devices available. The usual methods involving additional bias on the grids of the r.f. or i.f. tubes appear inadequate and difficult to apply at high frequencies, as numerous attempts have shown.

The Approach

An r.f. amplifier is usually operated as a Class-A amplifier designed to permit signal-voltage excursions somewhat in excess of those required to handle the signal levels ordinarily encountered. For this reason noise peaks, etc., come through without much hindrance. If the grid voltage range of the input circuits is too limited, cross modulation effects and partial demodulation may be expected.

In spite of these threatened disadvantages, it was decided to experiment with an r.f. stage with severely limited grid voltage range, and if possible, to make use of any rectification which occurred on voltage peaks to reduce the amplifier gain with a minimum of time lag. In any event, the control tube, or "signal metering valve" was to be followed by a regenerative detector and audio channel (or i.f. amplifier) to bring the signal up to the required level.

A little attention to the radio textbooks brought out the fact that opposite changes in plate current are produced by grid-leak detectors and plate or grid-bias detectors, i.e., strong signals cause a decrease of average plate current in the former, but an increase with the latter type. It was learned also that a grid leak detector may be expected to produce about three times as much change in average plate current as a grid-bias detector.

Bridge Circuit Possibilities

In order to make use of the characteristics mentioned a bridge circuit, in which the opposite effects would tend to balance the branches, suggested itself. A double triode was chosen for the first trial, even though feedback troubles could be expected. Accordingly, the circuit shown in Fig. 1 was set up, using one of the triodes as a grid-leak biased amplifier and the other as a cathode-resistor biased amplifier, both expected to operate at times as rectifiers.

It will be noted that the grids are driven in phase and that the two plates are connected to opposite ends of a unidirectional center-tapped winding in such a manner that the fields produced by the two plate currents will cancel each

* 5532 Tennessee Ave., St. Louis, Mo.

[1] J. J. Lamb, *QST*, February, 1936, and April, 1936.

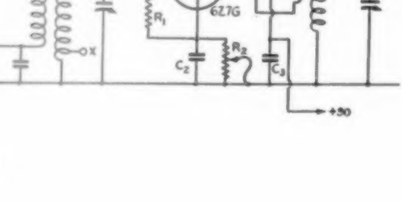


Fig. 1—Circuit arrangement of the signal-metering valve, using a double triode. In the author's receiver this circuit is inserted between a tuned r.f. stage and a regenerative detector. The coils have the usual constants for interstage applications; in the output circuit, L_1 has three turns each side of center-tap, L_2 14 turns total, for operation in the 14-Mc. band. Other constants are as follows:

C_1—100 $\mu\mu$fd.
C_2—250 $\mu\mu$fd.
C_3—0.005 μfd.
R_1—1 megohm.
R_2—5000-ohm variable.
X—tap for negative feed-back (see text).

The man with an autodyne receiver ought to turn out to be a pretty good operator—he has to cope with so many things, such as noise and interference, which the superhet owner has a chance to overcome. Except for audio limiters, practically all noise-reducing circuits have been aimed at owners and builders of superhets. The experimental circuit described here, however, is an exception—it can be used with either type of receiver, and it should not be hard to add it to a plug-in coil t.r.f. set. Certainly worth a trial if you're in a noisy location.

other, more or less. Assuming that the characteristics of the triodes are identical, and that they are operated at the same grid and plate voltages, the cancellation of the fields should be substantially complete, which is borne out fairly well in practice. By shifting the operating point of either triode with respect to the other, signals will be passed through because of the unbalanced condition.

Demodulation and Cross-Modulation

A milliammeter in the cathode lead of the signal valve shows a tendency to follow the modulation on strong signals, indicating demodulation of the peaks. For this reason and others, it is to be expected that the individual plate circuits carry harmonic currents, portions of which do not balance out in the common return to the cathode. However, the resultant signals, judged by the loudspeaker output, have not suffered sufficient distortion to make them any less acceptable, without being hyper-critical about them. Part of the explanation may lie in the fact that the "knee" of the resultant curves C in Fig. 2 becomes decreasingly sharp as minimum gain is approached. The least demodulation will occur when operating midway between the knee and plate current cut-off, a point dependent more or less on the operating conditions otherwise chosen.

During the time that the signal valve has been in use, no moderate cases of cross-modulation have been observed which could be attributed directly to this part of the receiver. As usual, the very powerful local 'phone signals effectively blanket any weak signals in their vicinity on the band.

Choice of Tubes

The experiments with the signal metering valve conducted to date have been confined to the use of the double triode, admittedly to save the work of installing an extra socket and the wiring for a pair of r.f. pentodes. The latter tubes should cause less trouble from feed-back between the plates and control grids. In the triode set-up, the plate coils must be kept reasonably small, should be close wound and placed near the ground end of the following grid coil.

As a further means of controlling oscillation in the triode signal valve, the by-pass condenser, C_3, from the center tap of the plate coil was disconnected from ground and connected about ¾ of a turn from the ground end of the triode grid coil (point X in Fig. 1). This is an application of the circuit trick discussed in an article in *QST* for March, 1938,[2] giving negative feed-back of currents in the plate return lead. With this arrangement, which may or may not give exact neutralization, the triodes become stable enough to work between a regenerative r.f. pentode and a regenerative detector without interlocking of the two except when the regenerative gain in the first circuit is materially advanced.

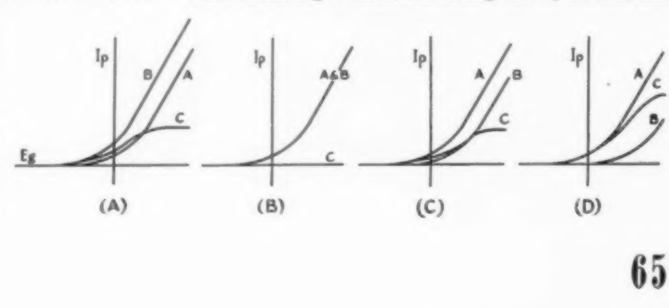
The grid circuit of the signal valve tunes rather broadly due to the loading effect of the grid-cathode resistances. In a superheterodyne or other receiver with automatic gain control voltage provided by means other than that described here, the signal valve circuit with both grids biased directly, instead of having one of them biased by grid leak, could be incorporated either as an r.f. or an i.f. amplifier. In the latter application, the need for providing a center-tapped plate coil would not present the same difficulties as in the high-frequency end, particularly in a multi-band receiver.

In Fig. 2 are shown some grid voltage-plate current curves to illustrate the effects which may be expected from the arrangement in Fig. 1. For the sake of simplicity, no consideration is given to the fact that the plate current of the grid-leak triode (A) depends upon the combined effect of the signal voltage and the bias developed across the leak by the grid current.

In Fig. 2 (b), the triodes have equal bias and

[2] H. O. Talen, "A Feed-Back Compensator for R.F. Circuits," *QST*, March, 1938.

Fig. 2—Illustrative grid-voltage plate-current curves for the double triode. A is the grid-leak section; B the cathode-biased section. Curves marked "C" are obtained by subtraction, for the condition of equal bias in (b) and for various differences in bias in (a), (c) and (d). The vertical line does not represent zero bias but instead is intended to show the point of operation, or no-signal plate-current point, of triode A. For practical tubes, the "C" curves will slope upward at the right instead of being exactly horizontal.



the "gain curve" is a horizontal line, C. In Figs. 2(c) and 2(d), the curves have been separated by increasing the cathode bias on triode B. The grid leak of triode A is returned directly to the common cathode connection and the bias developed on grid A is substantially independent of the change in voltage drop across the cathode resistor R_2, within limits.

As the difference in bias is increased, the resultant curves (C) begin to have sufficient slope to indicate amplification through the signal valve. Strong signals and noise peaks can be amplified to the full extent of the slope, but beyond that they can cause little change in the net voltage fed to the next stage, and accordingly the peaks are cut off or suppressed so far as the following circuits are concerned. In practice, the limitation of the peaks is readily appreciated, and the absence of noise crashes and blaring signals is a pleasant relief for which the price paid is a loss of part of the overall gain otherwise available from the r.f. stage devoted to control purposes.

If the bias on triode B is gradually made less negative than that on grid A, a similar series of effects would be obtained, as in Fig. 2(a). It may be necessary to apply an actual positive bias to the grid of triode B to obtain a sufficient separation of the characteristic curves.

Automatic Gain Control

As mentioned, the triode A, with grid-leak bias, tends to shift its operating point to a lower plate current, which is equivalent to moving its operating curve to the right. The decreased current should have the effect of lowering the voltage drop across the cathode resistor, thereby reducing the bias on triode B. The latter triode, on the other hand, will tend to draw a higher current, equivalent to moving its curve to the left by a relatively small amount. The net effect (when the bias on B exceeds the bias on A) is to reduce the slope of the resultant curve C, and therefore to reduce the effective gain of the signal valve. The length of the "linear" portion of the slope also decreases to a certain minimum which is a function of the curvature of the E_g-I_p characteristic of the triodes near plate current cut-off.

The net decrease in plate current caused by a strong carrier can be observed on a milliammeter in the cathode or plate lead, and amounts to as much as 10 per cent of a total current of from one to two milliamperes. The a.g.c. action, if any, on weak signals is important only as it concerns fading, and no experimental proof of such action has been attempted.

The proper setting of the adjustable cathode resistor, R_2, can be found readily enough by observing the point at which minimum signals are obtained, and then increasing the resistance until a satisfactory signal level, or the maximum tolerable noise level, is reached. The "minimum" setting depends upon the value of grid leak R_1 and the plate voltage used. In the experimental set-up, a one-megohm leak worked more satisfactorily than a half megohm or two megohms. The plate voltage was kept at about 90 volts, which may or may not be the optimum value.

Volume Expansion

From the foregoing discussion, it is apparent that a limited degree of "volume expansion" could be obtained by operating grid B at a more positive potential than grid A. It may also be noted that, when the biases are adjusted for low output with a.g.c. action, a strong carrier will reverse the relation of the biases and volume expansion will occur, particularly on modulation peaks. Under these conditions, the louder signals on the band come through with very little background and heterodyne noise. Transient peak voltages continue to be limited by the signal-valve action.

'Phone "Splatter"

(*Continued from page 29*)

not take into account practical limitations usually encountered in actual practice. As a matter of fact, it is safe to say that because of the above considerations most amateur stations cannot be modulated 100 per cent.[2] The remedy for the above condition lies in decreasing the Class-B plate-to-plate load, thus increasing both the peak current of the tubes and the value of minimum plate voltage. Although this procedure will cause overload for a sine-wave signal, for speech purposes the tubes are operating well within their average-current and plate-dissipation limits. In fact, it is possible to obtain a considerable amount of speech power by decreasing the plate-to-plate load to the correct value.[3] In conclusion, the intelligent use of the automatic modulation control circuit and the correct adjustment of the Class-B modulator will result in a clear-cut understandable signal which requires a minimum of band width and which causes a minimum of interference to adjacent channels.

[2] Provided good design principles are followed, however, the well-known tendency to use more than rated plate voltage, plus "conservatism" in providing more than enough audio power, account for the fact that there is a good deal of actual overmodulation.—EDITOR.

[3] For design information, see Anderson, "Speech versus Sine Waves," *QST*, March, 1938.—EDITOR.

Strays

When W1TS sent his msg nr 73 in the recent SS Contest, W7CMB replied with his nr 88. When 1TS sent his msg nr 88, VE3GT answered with his msg nr 73.

W2QY says, "The wiring arrangements of too many ham transmitters are not so well suited for the label 'Underwriter's Approved' as for the version 'Undertaker's Approved!'"

HOW WOULD YOU DO IT?

> **During the past year or two, Our Hero has uncovered many worth-while kinks of general interest in his search for solutions to his various problems. He feels, however, that the purpose of the Problem Contest would be better served if others brought their problems out into the open. He believes there are many knotty problems of general interest which pop up from time to time in the experiences of other amateurs.**
>
> **If you have a problem of general interest, or know of someone who has such a problem, why not jot it down on a card and mail it to the Problem Contest Editor, *QST*, West Hartford, Conn., and see what the gang can do with it? Even if you already have a solution, perhaps a better one can be found.**
>
> **We shall endeavor to use as many as possible of the problems submitted. How about it?**

ANTENNA SWITCHING WITH CONSTANT LOADING

IT WILL be remembered that Problem No. 22 (see *QST* for October) involved switching the transmitter to any one of several antennas of various types and, at the same time, maintaining constant transmitter loading so that the transmitter might be switched quickly from one system to another without adjustments of any kind.

All solutions received run along similar lines. A separate antenna tuner is provided for each antenna system. Low-impedance lines lead from the antenna couplers to the switching arrangement, and thence to a link, coupled to the output-amplifier tank circuit. Some means, such as a variable link, is provided for each antenna tuner so that coupling may be adjusted to the desired degree.

Fig. 1 shows various antenna-coupler arrangements. The arrangement at A is especially suitable for 400-, 600- or 800-ohm lines although it is sometimes used with tuned lines. The system at B will be recognized as the series-parallel tuner used commonly with tuned lines feeding Zepp or center-fed antennas. At C is shown the method of coupling to a simple voltage-fed antenna or to a single-wire transmission line. An antenna fed with a low-impedance cable line needs no adjusting coupler as indicated at D. W8OMM suggests the arrangement shown at E in which variable condensers are eliminated by the use of a variable-inductance coupler.

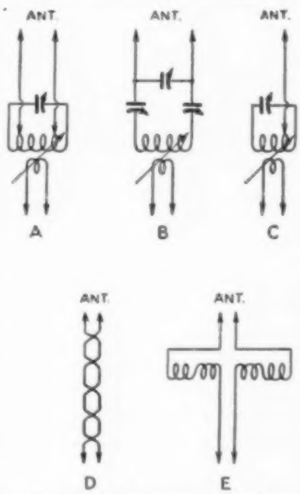


Fig. 1 — Antenna coupling systems. A — For medium impedance transmission lines. B — For tuned lines. C — For voltage-fed antennas or single-wire transmission lines. D — Low-impedance line. E — Variable-inductance coupler.

In A and C, the tank circuit should be capable of tuning to resonance at the operating frequency. At B, the size of the coil will have to be adjusted experimentally for the feeder length and frequency at which it is to be used. The size of the variable inductance coil at E will also depend upon the characteristics of the line with which it is to be used. The inductance should vary from 0.25 to 1 microhenry per meter for medium low-impedance lines. For tuned lines, the inductance should vary from about 5 microhenrys per meter to zero, depending upon feeder length.

The various schemes for switching the low-impedance link lines from one antenna coupler to another are shown in Fig. 2. At A, a pair of ganged rotary switches selects the proper link line while the d.p.d.t. switch or relay switches the particular antenna in use from transmitter to receiver. The arrangement at B, suggested by W1FHH and W1KFN, is the same except that one side of each link line is common so that a single rotary switch unit may be employed.

At C, a system of two d.p.d.t. switches by W3HDI is used to take care of as many as four antenna systems. At D, is the system of plugs and jacks used by W2JQM.

Adjustment

As mentioned previously, some means of adjusting the coupling between the link line and the antenna coupler should be provided in each case. This may be accomplished by providing a swinging link winding or by tapping the link line on the antenna tank coil. The output amplifier tank coil should also be provided with a variable link to permit adjustment of coupling and to remove d.c. voltage from the link line. If one of the antenna systems in use employs a low-impedance line of 70 ohms or thereabouts, the transmitter should be first tuned and adjusted for proper loading with this antenna system. The output tank circuit coupling should be fixed for this antenna system and the coupling for the other antenna systems should be adjusted at the antenna coupler rather than at the final amplifier.

The coupling for each of the other antenna systems is adjusted to duplicate the loading of the first.

Most communications-type receivers will work satisfactorily, even though most input circuits are designed for somewhat higher impedances, if the low-impedance line is fed directly into the input terminals, unless the connecting link lines must be of appreciable length. In this case, a circuit tuning to resonance may be placed near the receiver, and the receiver input and low-impedance transmission line coupled to this tuned circuit by means of separate link windings, preferably one of which may be varied for best matching. W8BYU uses 300-ohm lines to provide a better match for the receiver input. This line may consist of a pair of No. 12 wires spaced one-half inch. Once set, it should not be necessary to change the receiver coupler adjustment when switching from one antenna to another.

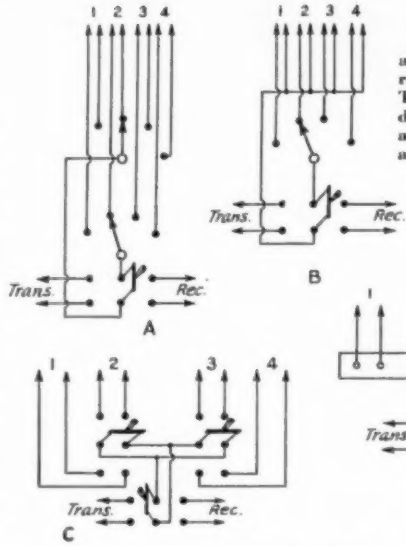


Fig. 2 — Those at A and B make use of rotary tap switches. The one at C employs d.p.d.t. knife switches and plugs and jacks are used at D.

With each of the antennas adjusted as described, it should be possible to switch quickly from one antenna to another, when the occasion arises, without the necessity for further adjustments.

Prize Winners

First Prize — Kenneth V. Curtis, W1FHH.

Second Prize — Floyd L. Rittman, W8BYU.

Rules under which the contest is conducted are as follows:

1. Solutions must be mailed to reach West Hartford before the 20th of the publication month of the issue in which the problem has appeared. (For instance, solutions of problem given in the January issue must arrive at *QST* before January 20th.) They must be addressed to the Problem Contest Editor, *QST*, West Hartford, Conn.

2. Manuscripts must not be longer than 1000 words, written in ink or typewritten, with double spacing, on one side of the sheet. Diagrams must be neat and legible.

3. All solutions submitted become the property of *QST*, available for publication in the magazine.

4. The editors of *QST* will serve as judges. Their decision will be final.

Prizes of five dollars' worth of A.R.R.L. station supplies or publications will be given to the author of the solution considered best each month, two dollars and fifty cents' worth of supplies or publications to the author of the solution adjudged second best. The winners are requested to specify the supplies preferred.

PROBLEM NO. 24

Our Hero is in a quandary. He put off replacing the halyards on his sixty-footer just a bit too long. The other day a stiff breeze put enough strain on the rope to break it. This leaves Our Hero gazing skyward, with one end of his antenna on the ground, wondering how he is going to replace the halyards without taking down the mast. The mast has two sets of guy wires, one set about half-way up and the other set at the top. How would *you* go about replacing the halyards?

Silent Keys

It is with deep regret that we record the passing of these amateurs:

Frank B. Arup, EI3M, Sandycove, Dublin, I. F. S.

Henry R. Chetham, W1HC, Somerville, Mass.

Robert S. Connavale, W3KFM, Springfield, N. Y.

Edward Germeroth, W2CHT, Ridgewood, L. I., N. Y.

Robert M. Henderson, W8LQO, Cedar Springs, Mich.

Lt. Allen Moore Howery, U.S.A.A.C., W4EJO, Knoxville, Tenn.

Arthur Kammer, W2PH, Lynbrook, L. I., N. Y.

Melford Sewalson, W7BDZ, Butte, Montana

George L. Steen, W3AYQ, Bordentown, N. J.

AN OSCILLATOR WHICH COMBINES MANY FEATURES

After four years of experimenting with oscillators, crystal and e.c., and using almost every oscillator tube from a '99 to my big 803, I have at last hit upon a solution to my woes.

Ideal oscillator requirements include the following conclusions:

1. The oscillator must key readily, even with cranky crystals.
2. There must be no chirp in the note.
3. Key clicks must be absent to permit easy break-in operation and also to avoid broadcast interference.
4. The oscillator must permit key leads of any length without resort to a relay.
5. The current keyed must be small to save keying contacts.
6. There must be no possibility of getting shocked when the hand is put across the key.
7. The base of the key or bug must be grounded to prevent shocks between receiver and key.
8. Crystal current must be less than 30 ma. at all times.
9. When operated as an e.c. oscillator the stability must be comparable with that of an X-cut crystal.
10. The oscillator must not require a special high-regulation power supply.
11. It must not require any outside power, or entail a loss in available voltage. (Vacuum tube keyer is thus unsuitable because of drop in voltage and because of need for extra equipment.)

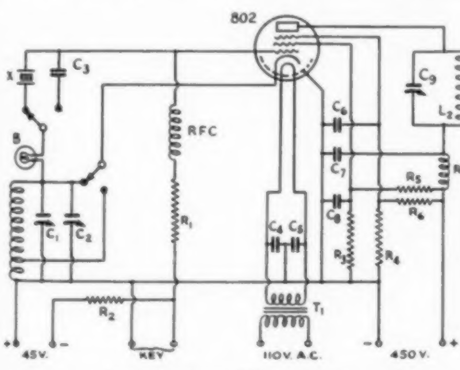


Fig. 1 — Circuit of the high-stability oscillator.

C_1 — 325-μμfd. receiving-type variable.
C_2 — 35-μμfd. midget variable.
C_3 — 250-μμfd. fixed mica.
C_4, C_5 — 0.01-μfd. fixed tubular paper.
C_6, C_7, C_8 — 0.002-μfd. fixed mica.
C_9 — 100-μμfd. midget variable.
R_1 — 10,000-ohm, 2-watt carbon.
R_2 — 50,000-ohm, 1-watt carbon.
R_3 — 10,000-ohm, 10-watt.
R_4 — 10,000-ohm, 1-watt carbon.
R_5 — 40,000-ohm, 10-watt.
R_6 — 150,000-ohm, 2-watt carbon.

Does your oscillator meet these requirements? If not, try the circuit of Fig. 1. I do not claim high power output for this oscillator, but it has high stability and good keying.

With a 7½-watt lamp as load, I experimented with various voltages and circuits, and found that the Tri-tet circuit with the 802 was the best suited to my purpose. Using a 60-ma. lamp to indicate crystal current, and variable resistors for obtaining proper voltage for screen and suppressor, I found that the output remained nearly constant down to 35 volts on the screen and 30 volts on the suppressor. The plate voltage was 450. With this potential, things did not heat up, and the crystal current dropped off so low that it did not light up the 60-ma. bulb at all; this was with a VF-1 80-meter crystal and output on 40 meters. After getting that part of the problem settled, keying was taken up. Keying the negative connection produced clicks, and besides one could easily get a shock when touching the key. Keying the ground lead of the cathode coil works very well with crystal control but not so well for e.c. operation as it causes variation of the frequency. Positive keying produced clicks and a chirp with e.c. Screen or suppressor keying failed to cut the output to zero, with the additional disadvantage of putting high voltage on the key. Finally, after studying the *Handbook* in search of ideas, I noted that grid block keying (illustrated for an amplifier stage) might have possibilities. No sooner said than done, so I installed a 45-volt battery to try it out temporarily. It worked so nicely that I haven't bothered to obtain the blocking voltage from a bleeder. Anyway, the battery is used to bias the 803 final, so why not use it if available? If a little more crystal current is not objectionable, the grid resistor might be increased, but I found by using a variable one that 10,000 ohms was best for crystal and about 2000 ohms for e.c.o. I left it at 10,000 ohms, however, since undoubtedly many crystals would cause keying difficulties with only 2000 ohms. However, the lower the better from the

standpoint of crystal current. I might mention that this VF-1 crystal has a minimum frequency of 3500 kc., and it is often operated for output on 7000.2 kc., so crystal current is especially important with a negative temperature coefficient of the crystal.

Using the e.c.o., the only difference I can detect is the fact that a ripple is slightly noticeable. This is as expected, for the present filter is inadequate for an e.c.o. More is to be added later. The crystal tone is quite pure.

No shock is possible, and the key leads are over 50 feet long. The keyed current is exceedingly small.

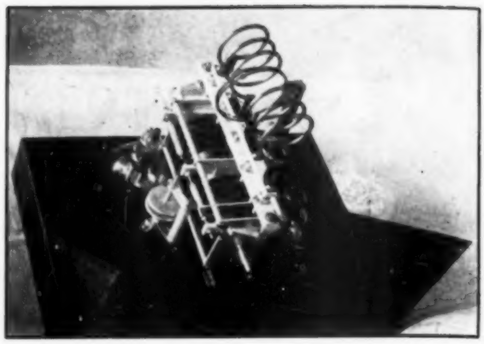
Although I have not had a chance to use it very much since I built it, all reports have been crystal, and most of the fellows are very much surprised to know that I use e.c.o. It is very stable and the drift is negligible. The low screen voltage plays an important part in reducing drift. The accompanying circuit is that of the resulting oscillator (Fig. 1). It could be simplified somewhat by use of a single low-resistance bleeder with taps, using the power supply itself for the blocking voltage (which is between 22½ and 45 volts).

—Alan Buffington, W3EEW

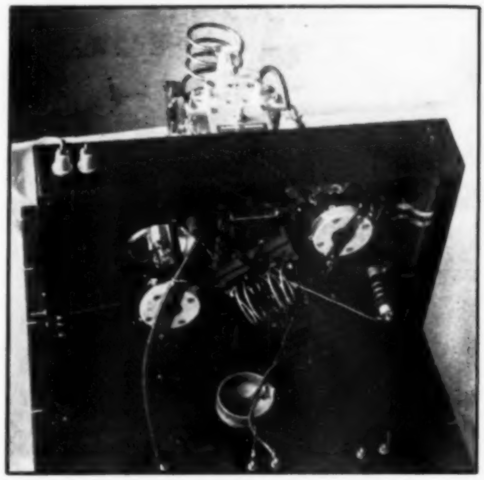
TROUBLE GOING TO TEN METERS?

After much difficulty had been experienced in attempting to drive a push-pull amplifier on ten meters with an 814 buffer stage, it was found that rearrangement of the amplifier parts and wiring made possible an increase of excitation grid current from 50 to 70 ma. The layout which resulted from experiments with the ten-meter amplifier is shown in the accompanying illustrations.

The grid coil is mounted directly on the Cardwell MT70GD tuning condenser (equipped with high-frequency dielectric strips) which is mounted beneath the chassis with rotor plates almost touching the chassis when open.



Views above and below the improved amplifier arrangement.



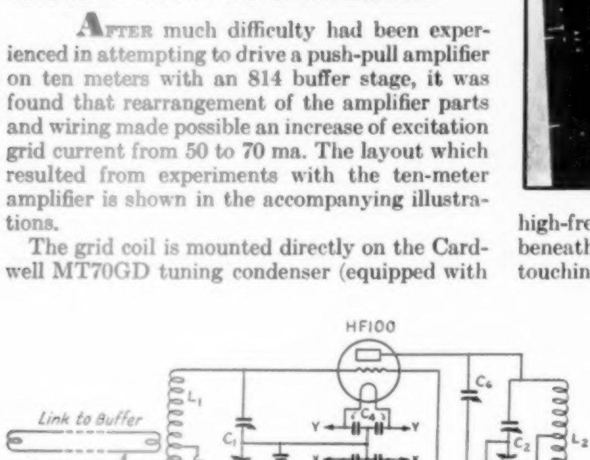


Fig. 2 — Circuit of the revised ten-meter amplifier. The circuit and parts used are conventional in every respect, and suitable constants may be taken from Fig. 859, 1939 Edition of the Radio Amateur's Handbook.

Feed-through insulators directly in line with the bottom plate connections of the neutralizing condensers make possible extremely short leads, while the top plate connections of the neutralizing condensers extend almost directly to the stator connections on the plate tuning condenser.

The Johnson 70DD70 plate condenser was chosen for several reasons: Reversing the end angles and extending them by using the panel mounting pillars (supplied with the condenser) permitted mounting the B. & W. high-power coil directly on the condenser. The construction of the condenser (with stator plates flaring out to greatest over-all width at what is normally the base of the condenser) makes it possible to have the tops of the amplifier tubes come almost to the stator terminals.

It is particularly important on ten meters if

the r.f.-carrying links between stages are long and are likely to have fairly high r.f. voltage across them, that a line using good high-frequency dielectric be used rather than the more common twisted-pair line. The latter type became quite hot when used to couple the grid circuit of the ten-meter amplifier to the plate circuit of the buffer, and since the total power output of the buffer is small compared to the output of the transmitter, noticeable heat at this point represents a relatively large loss of driving power. The link used here consists of two No. 12 wires spaced ⅛ inch between centers. The wires are held in this spacing by tight-fitting holes drilled through small blocks of Victron.

Four filament by-pass condensers are used; two are connected directly to the filament terminals of each socket, and the four ground ends of the condensers are connected to a ground point on the chassis. Separate heavy twisted pairs are then run to the filament transformer, which is placed in an inconspicuous position beneath the front of the chassis.

Although no circuit change was made when the final amplifier was rebuilt for ten-meter operation, and although the circuit used (see Fig. 2) is quite conventional, the rearrangement of the parts from the former layout which required longer connecting wires and longer ground return paths has made it possible to more than adequately drive the amplifier with an 814 buffer which, previously, had insufficient output.

—*W. K. Thomas, W8QAN*

EMERGENCY GRID TANK

Although crystal frequency control alone may be used during normal operation of an amateur station, provision for readily converting the oscillator from crystal control to self-excited operation may be of value for several reasons. For instance, it is sometimes desirable to make measurements on an antenna system for a wide range of frequencies, or to determine whether certain tuned circuits in the transmitter are capable of covering entire bands. Unless the operator is so fortunate as to possess several crystals of suitable frequencies, self-excited operation of the transmitter is the logical solution for these purposes. Probably a greater reason for providing some means for self-excited operation is the possibility that some unforeseen condition might make it very important that the transmitter be operated on some frequency for which no crystal is readily available, with the stability of the oscillator a secondary consideration in this case.

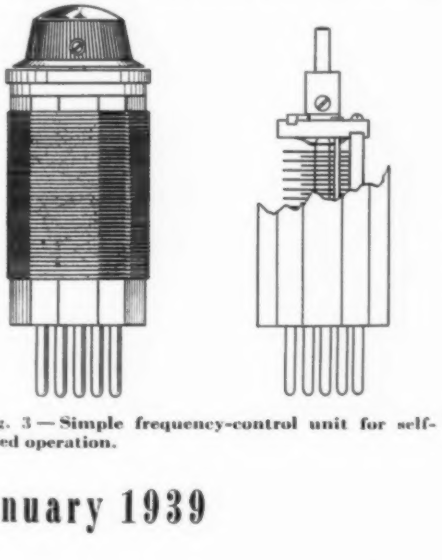


Fig. 3 — Simple frequency-control unit for self-excited operation.

The simple and effective coil-and-condenser tank shown in Fig. 3 is the outcome of such thoughts on the part of Walter S. Rogers, W1DFS. A 5-prong coil with tuning condenser internally mounted is used for the complete gadget, with one end of the winding and one connecting wire from the condenser connected to one of the base pins ordinarily used for crystal connection, and the other condenser connection and coil end connected to the other crystal pin, as shown in Fig. 4. The coil form is a Hammarlund SWF-5, and the condenser is a Hammarlund APC-100 midget designed especially for mounting in the form. The condenser shaft at W1DFS is provided with a bushing-type shaft extender, and a bakelite knob is used for convenient tuning of the tank. Alternatively, screwdriver adjustment of the condenser may be used—the shaft is made with slot provision for this purpose.

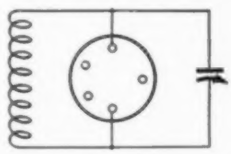


Fig. 4

Tanks for the 160-, 80-, and 40-meter bands are made by closewinding 60 turns, 23 turns, and 12 turns, respectively, of No. 22 d.c.c. wire on the 1½-inch diameter coil forms. These inductances allow tuning on all three bands in the maximum capacity range of the condenser.

Strays

James Dickert ("A New Automatic Noise Limiter," *QST*, November, 1938) drops us a note to say that the 6Y7G or 6Z7G can be substituted for the 6M7, 6A6, etc. in the noise limiter with equally satisfactory results. The advantage is that these tubes have smaller envelopes and therefore probably can be fitted more readily into existing receivers. Another point of interest to builders of the circuit is that hum caused by heater-cathode leakage can be cured by reducing the heater voltage; 3½ to 4 volts on the heater is sufficient for good circuit operation, and eliminates hum from this source.

OPERATING NEWS

F. E. HANDY, Communications Manager **E. L. BATTEY, Asst. Communications Manager**

The Member Party. The biggest event in operating, to start the year off right, is the special activity dedicated to all League Members, to be held January 7th and 8th . . . call-emblem-insignia prizes . . . only League members eligible. See the announcement back a few pages and get in on the fun!

Use MH-ML-HM-LM Sub-Band Tuning. We repeat below the tuning definitions [1] discussed last month with suggestions from outside this country on how-to-work-DX. The point was that to make good QSO's easier, results better, all of us amateurs should use *all* our frequency bands, not just pile up on the edges ineffectively with only a few brute power radiators able to get through.

It is now suggested, with due thanks to W1AVB, that the QMH signals be described more completely, as applying to specific sub-bands rather than to entire amateur bands. At 20 meters, for example, we have in the U. S. A. a 400-kc. band which is (in operating effect) two "outside" sub-bands in which c.w. is predominant, separated by a central portion in which voice work predominates. It is logical that the QMH-QLM operating signals should *not* be used in cross-band operation, but should always apply with respect to *each sub-band segment* [2] *alone!*

All stations outside the United States are asked to make liberal use of the QMH, QML, etc. abbreviations or their equivalents in accord with example [2] below. In this manner more satisfactory contacts, much more free of interference, may readily obtain.

Emergency Readiness. OM Winter came early this year with extra-heavy snowfall. It is timely then to call attention to the fact that we should be prepared for the hazards of winter, and the likelihood of a flood season to follow. Amateur radio communication must be ready to function on short notice to replace disrupted or overloaded wire circuits in either isolated or general-relief-type emergencies. Preparedness is the prime need of the whole amateur service.

Have you equipped so you could go self-powered in a hurry should you find yourself the only skilled "radio" person in your community? Are you all lined up with the League's Emergency Corps (whether self-powered or not) so you know the practice and policy thoroughly? Are you lined up with your Coördinator so you know "just" where you would fit into the picture best in emergency?

Every amateur with a license should "register" in the A.E.C. Qualified men to represent the amateur service as EMERGENCY COÖRDINATORS are needed in scores of communities. These appointments are made by S.C.M.'s. E.C.'s have the responsibility of framing plans for almost any contingency for their locality, of forming local amateur-planning committees, and of maintaining contact with local officials, keeping the community aware of what we amateurs are prepared to do. As an individual amateur, maintain annual registration in the A.E.C. To those now registered: Be sure you return (filled out) the colored survey form that will reach you direct from Hq. after the turn of the year. It will be the "annual round-up" or roll call to insure activity and readiness, and we are obliged to drop those *not* responding in order to know just where we stand from a preparedness standpoint from year to year.

The new F.C.C. Emergency Regulations for the amateur service are explained (pages 405–407 and 420) in the new Radio Amateur's Handbook. Refer to those sections, or ask your local A.R.R.L. Coördinator what you must do, should a communications emergency condition arise. When F.C.C. "declares" a communications emergency these F.C.C. restrictions on 1.8 and 3.5–4-Mc. work become mandatory. More on Emergency Work next month.

—*F. E. H.*

[1] From "Operating an Amateur Radio Station:

QHM — Will start to listen at high frequency end of band and tune towards middle of band.

QMH — Will start to listen in the middle of the band and tune toward the high freq. end.

QLM — Will start to listen at the low frequency end of band and tune towards middle of band.

QML — Will start to listen in the middle of the band and tune toward the low frequency end.

[2] For example, 14,000–14,150, 14,150–14,250, 14,250–14,400 kc., 28–28.5 and 28.5–30 Mc., are typical sub-bands. The LOW and HIGH designations should refer to the extremities of each of these sub-bands in practical work.

If a DX station working at 14375 kc. uses "LM" or QLM after he signs, you may be sure he is tuning for stations working between 14,250 (the low end), back to his own frequency, about in the middle of the particular band segment. A radiotelephone specification of TUNING HIGH TO LOW (for QHL) would indicate tuning was to be 14,250 to 14,150 kcs., likewise.

BRIEFS

When you're out on your New Year's Eve celebration, try a CQ on your horn or other noise maker . . . you might be surprised — like W2KZQ was when he tooted a CQ while ushering in 1938, and raised W2JKN on the other side of the dance floor!

If you need Arizona for W.A.S., look for the following stations: 28 Mc. — W6KMM OIF IXC NGJ FZQ OJK OWX NGG MAE ORX GFQ KMG PNN NEL LSK JFO. 14-Mc. 'phone — W6IMR KTJ KVE; c.w. — PFL PEO CVW QAP PJP KMM. 7 Mc. — W6IYZ NXO PNN LYU NEL PUM QBX PFL 5GDT/6. 3.5-Mc. c.w. — W6NRP NVC BMC GBN NXO JJO QNJ KMM. 3.9-Mc. 'phone — W6KMM LJN HVY LKE POM OFE. 1.75-Mc. 'phone — W6LYG JIW PQQ OWX.

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An amateur radio station was displayed and operated at the DeKalb County Fair, Auburn, Ind., during the first week of October, '38. The rig was set up in a special booth in the county courthouse. Much interest was shown by the fair-goers. The transmitter used was the property of W9IWN, whose call was used. W9YZJ furnished the receiver, W9YCF the modulation meter and additional equipment.

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Attention is called to the fact that W hams too often do not put enough postage on QSL's addressed to Canada. Cards should carry a 2¢ stamp, letters 3¢.

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Flood Traffic

BY THERON E. TAPPAN, W8AVD

> **PRIZES FOR BEST ARTICLE**
>
> The article by Mr. Theron E. Tappan, W8AVD* wins the C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating or communication activity (DX, 'phone, traffic, rag-chewing, clubs, fraternalism, etc.) which adds constructively to amateur organization work. Prize winners may select a 1938 bound *Handbook*, *QST*, Binder and League Emblem, six logs, eight pads radiogram blanks, DX Map and three pads or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

We've got a pile of work to do
We short-wave hams, you know
When rivers rise to flood stage
Their banks to overflow.
Each tiny mountain rivulet
Swells to amazing size
As it feeds the roaring river
With the downpour from the skies.

Whole towns are swept like matches
In the rush of raging tide
And families gaze in terror
As they watch their homes subside.
Why can't we pull together
When disasters like this come;
Not fill the air with nonsense,
Making QSO's quite bum.

For in some tiny hamlet,
Or a city, dark and bleak
With no electric power,
No means by which to speak
Upon a friendly telephone,
Some ham, in grim despair
Works desperately with batteries
To put him on the air.

Don't heckle him with messages,
Don't make him leave his mike
To seek your friends and relatives,
For he can't take a hike
Through flooded streets and byways
To find some homeless soul
Who's likely fled for refuge
And found some dry, safe goal.

The poor guy's trying vainly
His QRR to send,
To tell of needy families,
To ask that help we lend;
For they need food and clothing,
And maybe serum too;
Upon the heels of floods you know
Disease is nothing new.

The Red Cross wants to hear his needs
So just stand by and wait.
And make efficient QSO's
Until the floods abate;
No time for wild hysteria;
Far better, don't you think
To keep the airways clear for him —
His one remaining link.

You wouldn't want your mike or key
To QRM his call
By booming out a signal
When there's no need to at all.
So forget your pride and power,
Keep the ether clear for him.
Give him help — for boy, he needs it;
Don't you know his power's dim?

* 547 Clark St., Waverly, N. Y.

—···—

BRIEFS

Didja notice W1AW's *advertised* amateur transmissions on 8001 kc. (page 20, Dec. *QST*)? It should have been 1800 kc., of course. We're going to make the proof reader answer the pink ticket!

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In connection with 1.75-Mc. Trans-Atlantic work G2PL reports logging W1AW (R5 S2) on 1808-kc. 'phone at 11:30 P.M., EST, November 12th, and on 1800-kc. c.w. (RST 459) at midnight EST, December 3rd.

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W1CPV reports the following: The Leichardt Expedition in the Simpson Desert, Central Australia, is operating two transmitters on 187, 56.6 and 34 meters under calls VK8WA and VK8WB. Very low power is used, two to four watts from a pedal-driven generator.

The Casper Radio Amateurs Club entered this distinctive float in the "Wyoming on Parade" celebration. At the operating position is Stacy K. Anderson, W7FWM, club president. H. McFarlane, W7CBL, is driver of the truck, which was donated by Charles Burdick, W7EOT, and decorated by club members.

How's DX?

How:

THERE's no doubt but what it's a fine thing to believe in Santa Claus. We do, especially when we call someone the whole band's calling. And no doubt a lot of other folks do, if the letters we get are any indication. Lots of people write in asking us to check our QSO lists from EL2A, HH4AS, PJ1BV, etc. Sorry, but no have got. The only lists we do have, which we use *only* for checking for the Century Club (or WAC) are from PK6XX, OX2QY, K6NVJ, YV2CU, I7AA, YA5XX and YS2LR (through Nov. 17th). These lists were obtained as a convenience in helping fellows get confirmation from some of the hard-to-get-cards-from countries. We don't send out QSL's for the above stations. The only other way we can help you get confirmation on some of the tough ones is from the DX Contest log of the station, if he sent in one. You can check that by taking a look at the results of the Contest — if your DX station has a score listed, he sent in a log.

One more ray of sunshine: the SARRL returned ZS3F's SARRL DX Contest log to him (his cards, records and stuff had been destroyed in a fire), and if you write to ZS3F direct you can probably get a card from him, if you worked him in the Contest.

Where:

There isn't any doubt now about VS3OL, in case you were holding out hope. VS2AG, the BERU rep in Malaya, says there ain't no Cerabanga, and suggests that the guy was operating somewhere in W4 or W5, from an examination of the cards sent for QSP . . . . . I1LD worked ZC4EB (14,320 T6), who said he was the operator of the radio station at Nicosia, Cyprus . . . . . W2CMY, who skeds XU4XA (14,290 T9), says the guy is quite OK, that he uses an HRO and 180 watts to an 803, and *may* go Tibet in the near future . . . . . Yes, there was an EP5SO actually on the air for a short while. He was quite legit, but got scared and quit before he worked any W's. Some BL took up the cause and signed the call, and the purpose of these rambling lines is to tell you, if you're a W, that you didn't work the real EP5SO but the phoney . . . . . W6OFD grabbed a nice one in ZC3D (14,370 T9) at Christmas Island, whose home station and the place to send your card is ZD1D at Sierra Leone . . . . . It just doesn't pay to brand screwy calls "phoney" until you have some evidence. For example, who'd think that ZK2AG, worked by W8JSU some time back, would have turned up legit? But he did, and the sad part is that he left Niue on Dec. 8th . . . . . Maybe CR8AF (14,415), worked by W3EVW and W9RRT, is good, but it takes a lot of Pollyanna to go for UH1AA (7195 T3), worked by W2GSA and claiming to be in Hejaz . . . . . Choicest among the Asians that have been popping through to the east coast during the past month was J9CA (14,310 T9), worked by W2BHW, W4CBY and W8CRA, and known to be quite legit. Also choice but not so certain is VS5AG (14,415 T8), worked by W8JMP and W1FH . . . . . W4BPD heard FO8AR (14,410 T7) one evening . . . . . New countries, for a lot of folks, can be had in PK4KO (14,120 and 14,360 T9) and CN1AA (14,360 T9) . . . . . No dope on PJ6AR (14,420 T6), but PJ1BV (14,425 T6) is quite good . . . . . One of the reasons you haven't received a card from CX2AJ may be that you sent your card to the wrong address. Try one to Jose Enzo Sommaruga, Marco Bruto 1168, Montevideo, Uruguay, says W8NBK, and you may have better luck. NBK did . . . . . Panama is a tough place to find a signal from these days, and W8AU suggests looking around 14,355 for a T8 signal signing HP1G. He's undercover, so take it easy with the card . . . . . W4ERD grabbed some cream for himself when he worked VQ5KLB (7350) one night. That's the only station in Uganda, you know . . . . . W8DHU scared up G3QF (14,320) for an Isle of Man contact . . . . . CN8MI says that all CN cards should be sent via the A.A.E.M., Box 50, Casablanca, Morocco . . . . . Good bets, picked at random: HS1BJ (14,035 T9), VS1AA (14,030 T9), VS1AL (14,350 T9), LZ1ID (14,380 T7) QSL via HB9CE, U8IB (14,320 T9x), U9AB (14,410 T9) and CR6AI (14,170 T7) who, by the way, QSL's . . . . . if you hear any "D" calls ending in "W", they'll be ex-OE stations.

When:

G2PL is still pounding away on 1730 kc. Sundays from 0430–0600 GT. So far W1BB and VE1EA are the only ones trying to work him, but they tell us there's room for one or two more on the band.

The 3.5-Mc. band isn't as good yet as we thought it would be, or else our ears need overhauling, but there's a gang on every Saturday night trying to get across. W8PWU, who did some swell work there last year, made up a time table for 80, which shows that 04–08 GT should be the best time for Europe, and 08–12 GT the best for Oceania . . . . . W6AM raised ZL2BN on 75 phone during the SS . . . . . The USKA advises that several HB stations are active daily on the low end of 80, between 05 and 07 GT.

On 40, J2PJ (7140 T8x) is on regularly from 12–14 GT, and was S8 when W5AVF in Mississippi worked him . . . . . W7GZN reports TI6RR (7100 T5) and ZP2AY (7100 T9) around midnight PST.

Ten looks fair, what with W3CBT reporting VQ4CRE (28,040), VQ3TOM, SU1MW (28,360), SU1AM (28,260) and U9BE . . . . . There are a lot of ZL and CN 'phones on 10, in case you're interested.

There seems to be a difference of opinion on 20 — some argue that conditions are swell and others say punko. We'll present the evidence and you can be the judge . . . . . The rotary at W8OPB accounted for J8CG (14,420 T8), J2JJ (14,390 T9), VQ3HJP (14,410 T8), VQ2PL (14,410 T9) and VQ2MI (14,330 T9) . . . . . Among the cherce at

The antenna system at VS2AE, Perak, F.M.S., is a rotatable half-wave W8JK flat-top directional job on top of an 80-foot tower. Four hundred quarter-wave radials are buried 6 inches underground at the base of the tower, and the node point of the antenna link is grounded to the center of the radial system.

The transmitter runs 100 watts to the final pair of suppressor-modulated RK20's; the receiver is an HRO.

The transmitter line-up at J9CA is 59x–59–210, running 20 watts to the final. The receiver is a 1-V-2 a.c. homemade affair, the antenna a full-wave Zepp. Look for J9CA on 14,310, T9, from 13–15 GT.

W2HHF are CR7AF (14,275), VU2LK (14,020), VU2FX (14,330 T8), ZE1JT (14,310), VU2EU (14,340), VS4JS (14,050), XU7CK (14,360 T8), VS7AR (14,380 T8), XU8CM (14,300), XU8DI (14,410), VU2FO (14,350 T8), VK9BW (14,430), TF3C (14,380 T7), UK8IA (14,335 T7) and J8CA (14,350 T8) . . . . . . At W9WJD it's ZD2H (14,300 T9x), FI8AC (14,405 T9), K6DSF (14,398 T9x), YS2LR (14,410 T9) and VP2AB (14,410 T8) . . . . . . W1FVF adds HC1PZ (28,065 T9), VP1DM (14,270 T9) and NY1AB (14,260 T9) . . . . . . G6RH gives us the British slant with VP8AD (14,390 T8) at about 22 GT on Saturdays, K6TE (14,300 T9), NY1AA (14,300 T9), HR7WC (14,410 T9) and VP2AT (14,415 T9) . . . . . . From W9AIW's log: ZE1JS (14,370), CR7AG (14,300 T9), HR2ON (14,410) and X8V1SM (14,420 T9) . . . . . . The new lazy H at W2BHW is really laying down a smack in the tough places, what with J3CG (14,310 T9), PK1BO (14,395 T9), XU7CW (14,405 T7), XU6D (14,165 T9) and J4CP (14,335 T9) . . . . . . W4BPD grabbed off CR7AL (14,235 T9), CR7AY (14,005 T9), CR7BT (14,115 T9), VK9VG (14,420 T9) and OY4C (14,405 T9) in the late evening, and J3FK (14,440 T9), XU2JN (14,395 T8) and J2NF (14,425 T9) in the early yawning . . . . . . W8JDB added PK1TM (14,190 T9), ZB1R (14,300 T9) and FA8DA (14,355 T8).

What:

If, like the poor, e.c.o's are going to be with us, we might as well give you a few tips on how to get a half-way decent note with them. The sweetest sounding one we've heard (and, unfortunately, we've heard plenty) is the one W6CUH finished recently. Instead of just slapping the thing together and sliding it into the band the same evening, he went to the trouble of completely shielding it, filtered all power leads into it, removed it some distance from the transmitter (to minimize the r.f. pickup) and included the stabilizing part of a stabilized power supply in the cabinet. A 6L7 tube is used for the oscillator. Listening to it, it's hard to believe that it isn't crystal. Too bad that pride doesn't enter into the construction of more of them.

Who:

It's nice to know that some of the HH stations have friends at court. Some time back we cracked that HH2B and HH4AS were the only QSL'ing-HH's, with the result that the more fair-minded lads took up the cause and inform us that HH2MC, HH2LD and HH2X also send the pasteboards. OK, we'll start impeaching . . . . . . W5EWZ says that TG9BA has permission to operate and cards don't have to go under cover. 9BA will be on c.w. in the very near future . . . . . . Just when we figured that W4CBY was pining away because his side-kick W4DHZ got hitched, along comes a letter telling of the latest DX down there. It reads like the Call Book, including some prime slices as FN1C, FG8AB, J9CA, ZB2A, VS1AI, CR6AI, PK4KO, HS1BJ, CN1AA, LZ1ID, YI2BA, and a whole mess of J, XU, VS6, VS7, VU, XZ, PK and VK9, for a new total of 140 countries worked. Yeah, guess he hasn't given up DX yet . . . . . . EI6M, who has the most westerly QTH in Europe (outside of TF), is QRP but quite anxious to work W's . . . . . . W2GMM worked XI1ER and received a card from I1ER, with no explanation for the "X." Which leaves us right where we started . . . . . . Speaking of Italian stations, W1KH was told by I1KN that "I had to pass judgment" for having a radio because some "dumb ham wrote me a letter." So, once again, take it easy with those ticklish countries, and don't mention radio on the envelope . . . . . . VE5HR, the QSL Manager out that way, takes issue with the claimed record of W9RSU and W9WWL that theirs was the best DX QSO in the same call area. VE5HR worked VE5ACS on Resolution Island, the distance being a mere 2385 miles . . . . . . W9EF tells us that ZD4AB has gone up the coast to Takoradi but will be back on from Accra about Dec. 20th. He's going back to England in March, so you'd better grab him before then . . . . . . DX stations on the prowl for Mississippi will do well to look for W5AVF (14,300) and W5AUB (14,050, 14,295, 28,100) . . . . . . W9HLF skeds VU2FX (14,350 T9x) daily, and will be glad to help anyone get a VU QSO . . . . . . FI8AC needs Nevada, R. I., S. D., N. M., Alabama and Arkansas for WAS. Incidentally, FI8AC deserves an orchid or something for the swell way he keeps up with his QSL's, which sort of disproves any moans that "it can't be done." He has warmed many a cockle by his prompt cards . . . . . . OQ5AE, back in the States for a short vacation, says the most consistent W's over in the Congo are W8JK on c.w. and W4HX on 'phone . . . . . . This darn town of Ridgewood, N. J., has three C Clubbers: W2BHW, W2CMY and W2GVZ . . . . . . W6ITH, who skeds PK6XX, says that the expedition will have a good 28-Mc. signal soon, via a rotary beam, and that they're boosting their 14-Mc. input to a KW. If they'd only get on c.w. more, all would be peachy . . . . . . W1COI has been grabbing some nice ones on both phone and c.w. Some of the phones include SV1CA, ZB1L, CN1AF, HC2HP, I1NQ, PK4KS, CX2AK and VU2BG . . . . . . W2AZ grabbed his 100th country the other day, which may not sound so amazing until you know that all 100 have been worked *on phone!* . . . . . . VO3X has been giving a first VO to a number of the Asians during the recent good Asian spell . . . . . . W1HX has a new rotary and added 10 new countries with it right off the bat . . . . . . HK5JD (7095) still needs S.D. for his WAS. He's on around midnight EST . . . . . . ZS1CN (14,340 phone or c.w.) wants Nevada for the usual reason. W3HKY can arrange a sked for you . . . . . . Things aren't so bad in W7, according to W7FMX. PK4KS ZE1JI, J8CD, HB9J, HC1PZ and YS2LR are some of the latest . . . . . . The season's best, me hearties; may all your neighbors use straight razors instead of those #*&# electric ones!

PJ3CO:

It was mighty pleasant to learn from PJ1BV the other eve that PJ3CO got off with only a $40 fine. An agent from the N.V.I.R. intervened for him.

— *W1JPE*

Further Operating News on Page 84

CORRESPONDENCE FROM MEMBERS

The Publishers of *QST* assume no responsibility for statements made herein by correspondents.

SAFETY CAMPAIGN

Rapid City, S. Dak.

Editor, *QST:*

. . . I wish to tell you about a safety campaign which our club has decided to launch here in the Black Hills territory, for better fused and shielded power supplies, and in so doing hope to eliminate the possibility of such an accident as Ross Hull had a short time ago. His death has been truly a great lesson to all of us, and we think it would be a great benefit to all amateurs to become more conscious of such a danger.

We have worked out a seal and have named it the "Hull Safety Seal" in memory of him, which we are planning on using in our club. A committee has been appointed whose duty it is to inspect all equipment of each amateur who is a member of our club, and when such equipment has been passed upon as being satisfactorily safe according to the rules set up by the club, the member is then entitled to use the "Hull Safety Seal" on his QSL cards and on other correspondence with amateurs.

After we had our own plan worked out it was suggested that we submit it to the League, hoping that they would be interested in our project and perhaps turn it into a nationwide campaign. The seal has been copyrighted, as you will notice. We did this to prevent anyone from commercializing it, and in case the League should wish to adopt our plan as a national project we should be very glad to turn over the copyright to them. . . .

— *Gerald F. Lee, W9YKY*
Pres., Black Hills Amateur Radio Club

Editor's Note. — This is an admirable project. Its success necessarily depends on local inspection and control, and it seems therefore to be a matter best handled by the individual local affiliated clubs. *QST* heartily endorses the application of this idea on the part of amateur groups generally, and will welcome reaction and response.

A LETTER FROM DIRECTOR MATHEWS

100 E. Ohio St., Chicago, Ill.

Editor, *QST:*

As you know, I have not been a candidate for re-election to the office of director of the Central Division of the League. The reason for this, as you also know, is that, prior to my original election two years ago, I had allowed my operator's license to lapse. At the first meeting of the Board which I attended, the constitutional provisions covering directors' eligibility were changed to provide that a candidate for this office must have held an operator's license continuously for a period of four years prior to his candidacy. Obviously this was impossible in my case, as it is physically impossible to do something in two years that requires four for its accomplishment.

I was amazed to receive the notification that, due to the ineligibility of all the other candidates nominated in the Central Division, the by-laws provide that I should serve another term as director for the next two years. While it certainly was not my intention to occupy this position again, I want to assure the members of the League in the Central Division that I will do my best to continue to represent them to the best of my ability and to try to accomplish through the Board the things which they tell me they wish done.

I believe the situation brought about by the present wording of the by-laws covering eligibility is a most unfortunate one. It is my understanding that there were five candidates for the office of director, all ineligible for various technical reasons and any one of whom, I am sure, would have made an excellent director for the division. (While I myself voted for the eligibility rules mentioned, I did so in the belief that they were satisfied by any continuous term of four years as a licensed amateur operator and not necessarily the four years immediately preceding nomination.) It will be my first concern at the next Board meeting to do my best to see to it that the Board alters these provisions in such manner that this situation can never occur again. Our League is, and must continue to be, a democratic institution whose directors are elected by the members. I do not consider it proper to have restrictions so severe that mem-

(Continued on page 78)

In spite of the commercial air lines and high-speed streamlined trains, it is still quite impractical for anyone to make much of a dent in the job of getting around this country of ours and personally contacting, even with a fleeting greeting, an appreciable percentage of our customers, friends and "over-the-air" acquaintances. Even so, we do make the attempt as frequently as possible. In addition to making new friends, renewing old friendships and, of course, doing a little business, we inevitably in our travels learn of many interesting and, to us, unthought of applications for our products as well as changes and improvements that can be made to them. Of course, many of our friends also write to us when they feel that they have an interesting idea. Many of these items have been presented in this page in the past.

Thus, just recently Jack Thorpe, W8IDG, suggested a jack to fit the top of our GS-3 and 4 insulators. It is similar to the one now used in the GS-8 but designed to screw into the tapped hole on the Isolantite body. When ordering, just add the symbol "J" to the stand-off type number. The net cost is but six cents more.

Then, just a few days ago, we received a letter from Willard Minton, W5FVE, calling to our attention the fact that the new line of "air-wound" buffer coils could be easily mounted on the back of the TMS type condensers. Just enlarge the two small holes in the condenser end-plate and mount one of the PB-16 sockets. The holes in the condenser end-plate don't quite line up with the coil socket mounting holes but the "enlarging act" takes care of that situation in a quite practical way.

Herb Hollister, W9DRD, has been after us for quite some time to change the electrodes of the "4-in-1" crystal holder from the straight pressure type to the fixed air-gap type, by providing three small raised points on each plate. The activity of the crystal when thus mounted is increased considerably and of course the necessity for having spotlessly clean plates is eliminated. When the crystal is so mounted, however, it is likely to have a slightly different operating frequency than when mounted between flat plates or in a different type holder. Therefore, whether the holder be one of our new "4-in-1" or of some other make, frequency checks should be made under normal operating conditions. Of course, the new regulations also make this compulsory.

Incidentally, Herb also had some other ideas on crystals, particularly on extremely simple and practical methods of using them for fixed frequency reception in connection with the control of the high frequency oscillator of standard communications receivers. The whole thing is a little involved to present on this page, however, and we hope *QST* will want to describe the affair in more expansive editorial space in the near future — and in the meantime,

Merry Christmas and Happy New Year!

James Millen

Correspondence Dept.

(*Continued from page 76*)

bers in the Central Division are deprived of their opportunity to cast ballots, as they were this year. Insofar as my personal feelings are concerned I want to promise them here and now, as I said earlier in this letter, that it will be my first concern to remedy the conditions which brought this situation about.

— R. H. G. Mathews
Central Division Director

Editor's Note. — A League by-law provides that a director is elected for a term of two years, "or until his successor is duly elected and qualified." This is a customary provision and is deliberately made to prevent a situation wherein a division, through failure to name eligible candidates, would be left without a vote and representation at Board meetings. Because not one of the Central Division nominees complied with the new eligibility requirements, there was no election in the Central this year and Mr. Mathews remains in office, so that the division is not deprived of its vote. See By-Law 21. As to the eligibility provisions themselves, members will be interested in knowing that the Executive Committee is recommending to the Board that it make a further study of its rules so as to prevent the disqualifying of so many otherwise desirable candidates.

HQ SALARIES

230 Cleghorn, Honolulu, Hawaii

Editor, *QST*:

The quarterly statement of revenues and expenses for the three months ended June 30, 1938, is worthy of our notice. It is even interesting as compared to similar statements published in *QST* during the years of 1935 and 1936.

A casual comparison of such statements will show net revenues taken in by A.R.R.L. are remaining comparatively constant. It will also show salaries paid to officers and employees are steadily mounting. To-day $24,091.76 is paid out every three months in salaries. In 1934–35 that total was $19,252.08, or a net difference of $4,839.68. We see an increase in salary expenditures by 25 per cent.

As a struggling A.R.R.L. member I would like to know what has necessitated this handsome increase. How is the increase made up — more employees?

Do you in Hq. hold up your hands in horror at the thought of affecting every possible economy with the point in mind of eventually lowering membership dues? The nearly $5000 used for increases in salaries every three months would go a long way toward making possible the reduction in price of *QST* to 15¢ per copy (remember, there would then be some increase in circulation).

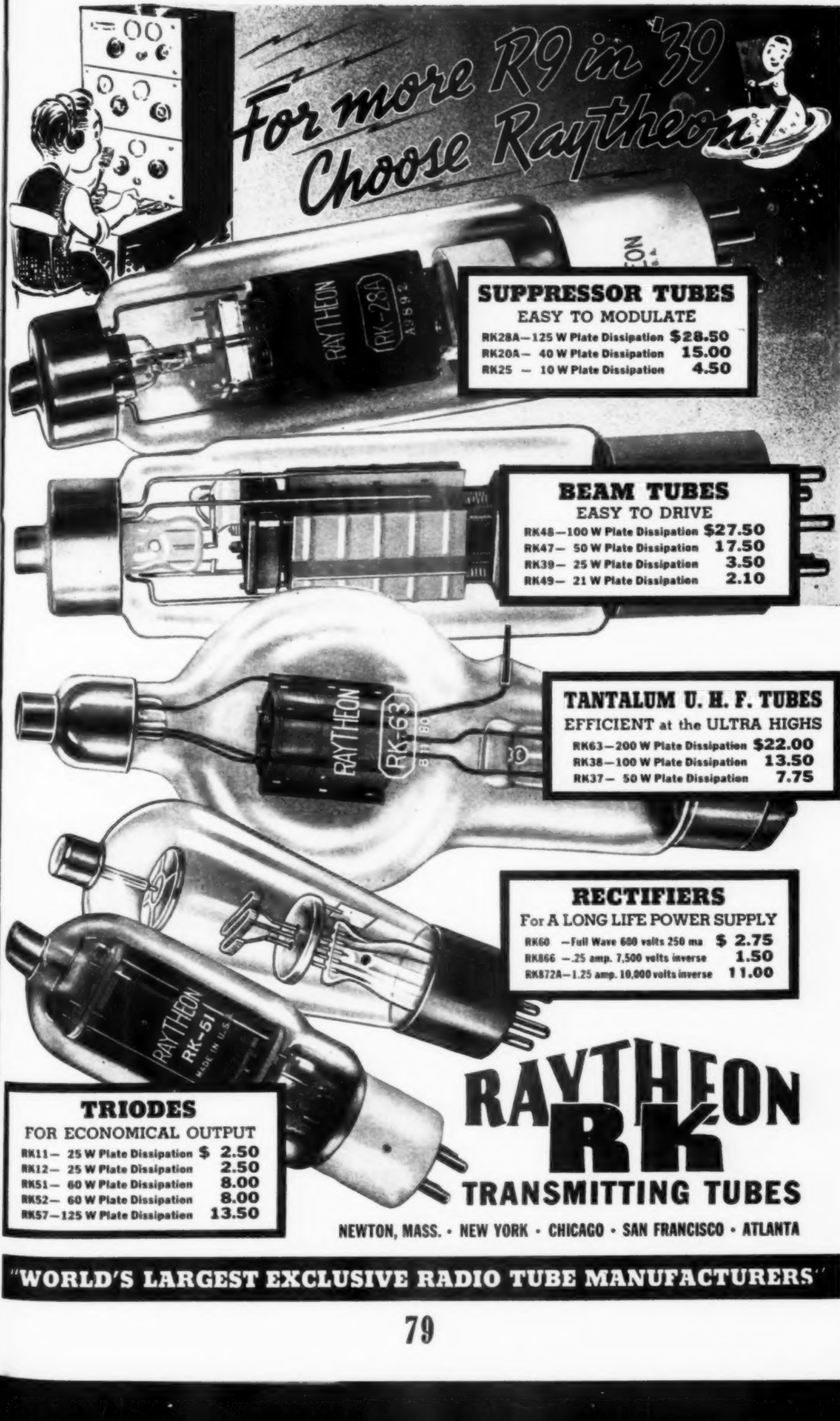
Perhaps I am all wrong, but I do not find the idea of $1.50 per year for A.R.R.L. dues an appalling aversion. A.R.R.L. publications to-day are not essentially bigger or better than in 1935. May I ask why the great increase in salaries?

— Stanley L. Grimes, K6PTY, ex-W7CQB-W3GRH

Editor's Note. — Three factors contribute toward the apparent disparity in the figures cited by Mr. Grimes: The League's pay-roll at the end of 1934 totaled 29 full-time employees, as against 37 in mid-1938; a general pay-cut of approximately 10 per cent was in effect in 1934 as a result of depression conditions; the purely clerical employees of the League (stenographers, shipping clerks, etc.) receive overtime wages for extra work evenings during busy seasons. With the growth of amateur radio the business affairs of the League have increased also, necessitating more clerical overtime and so raising this content of the pay-roll as well.

When these corrective factors are applied, the average salary paid employees is slightly less in 1938 than in 1934.

Incidentally, the percentage of total salaries to total expenses has been reduced slightly each year for the past several years. At the same time the proportion paid out for the production of *QST* (now in excess of $5.00 per member) and for general membership services (Communications De-


For more R9 in '39 Choose Raytheon!
RAYTHEON RK-28A
SUPPRESSOR TUBES
EASY TO MODULATE
RK28A—125 W Plate Dissipation $28.50
RK20A— 40 W Plate Dissipation 15.00
RK25 — 10 W Plate Dissipation 4.50
BEAM TUBES
EASY TO DRIVE
RK48—100 W Plate Dissipation $27.50
RK47— 50 W Plate Dissipation 17.50
RK39— 25 W Plate Dissipation 3.50
RK49— 21 W Plate Dissipation 2.10
RAYTHEON RK-63
TANTALUM U. H. F. TUBES
EFFICIENT at the ULTRA HIGHS
RK63—200 W Plate Dissipation $22.00
RK38—100 W Plate Dissipation 13.50
RK37— 50 W Plate Dissipation 7.75
RECTIFIERS
For A LONG LIFE POWER SUPPLY
RK60 —Full Wave 600 volts 250 ma $ 2.75
RK866 —.25 amp. 7,500 volts inverse 1.50
RK872A—1.25 amp. 10,000 volts inverse 11.00
RAYTHEON RK-51 MADE IN U.S.A.
TRIODES
FOR ECONOMICAL OUTPUT
RK11— 25 W Plate Dissipation $ 2.50
RK12— 25 W Plate Dissipation 2.50
RK51— 60 W Plate Dissipation 8.00
RK52— 60 W Plate Dissipation 8.00
RK57—125 W Plate Dissipation 13.50
RAYTHEON RK
TRANSMITTING TUBES
NEWTON, MASS. • NEW YORK • CHICAGO • SAN FRANCISCO • ATLANTA
"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"

partment, Washington and international representation, Board expenses, etc., totaling about $4.00 per member annually) has been increased.

Concerning the size of publications, the average size of *QST* during the last quarter of 1938 was 123 pages as against 109 for the same period of 1934. The 1939 *Handbook* has a total of 560 pages, compared with the 1935 *Handbook's* 282.

THE AMATEUR IS BALANCED

West Middletown, Ohio

Editor, *QST:*

I don't know when I have read an editorial that touched me more than yours in October *QST*.

I am an old Morse telegrapher and have seen some hard service in my time, but in the past twenty years I have been in the grocery business where I spend about seventy-five hours every week, so you see most of my time is spent with my business. Outside of several hours in the evenings and Sundays, I haven't much time for amateur radio, but I have been abusing myself by staying up too late at night and spending too many hours at it on Sundays. Therefore I haven't been getting the proper amount of sunshine and exercise needed by a man of my age, and I am not rugged physically.

I have caused blinking of the lights, key clicks in our b.c. receiver and maybe am not always in the best of humor when told about it, so have been a general nuisance around the house for the past three years — but, say, it's hard to stop when those VK's and ZL's are coming through about 589x! But when I read that creed of the amateur I feel awful guilty.

That editorial of yours sure did set me to thinking and I want to thank you from the bottom of my heart for it, and I hope it has the same effect on thousands of hams and may be the cause of saving them their health and much money in doctor bills in later life. . . .

— *John G. Hunt, W8QIE*

ABOUT CORRESPONDENCE

4450 N. Mozart St., Chicago, Ill.

Editor, *QST:*

Found this poem in a magazine and I think that if some of the hot air fiends who release their steam through this column read it they might think first before they let loose. Here it is:

ANOTHER'S FAULTS

In speaking of a person's faults,
Pray don't forget your own;
Remember, those in a house of glass
Should never throw a stone.
It you have nothing else to do
But talk of those who sin,
'Tis better you should look at home
And from that point begin.

— *J. H. Grigg, W9ZQT*

---

53 East 7th St., Holland, Mich.

Editor, *QST:*

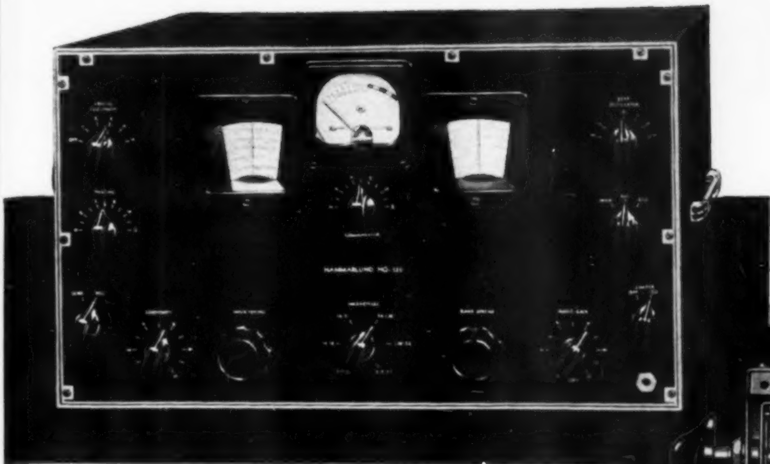
The Correspondence Section should be doubled in space allotment in *QST*. Some of the articles are very long and drawn out and there should be a minimum length of two or three inches per article.

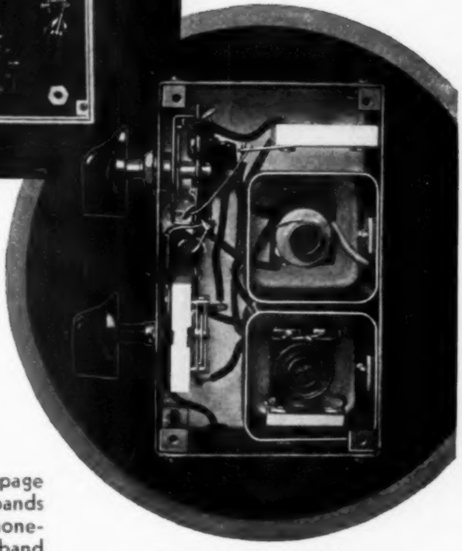
I think the Correspondence Section should include progressive thoughts for increasing the enjoyment we amateurs have in our most interesting hobby or at least one of the most interesting of all hobbies.

I also suggest that the fellows all get together and urge *QST* to publish a full page or even two full pages of nothing but photographs of some of the most active "hams" in the country. This should include station pictures as well as ops' pictures. Foreign stations also should be included. Also antenna systems that deserve publication.

This will greatly increase the average ham's interest in the magazine we all like, *QST*.

— *Rus Sakkers, W8DED*





LIST PRICE

$215.00

Complete with tubes, crystal, speaker

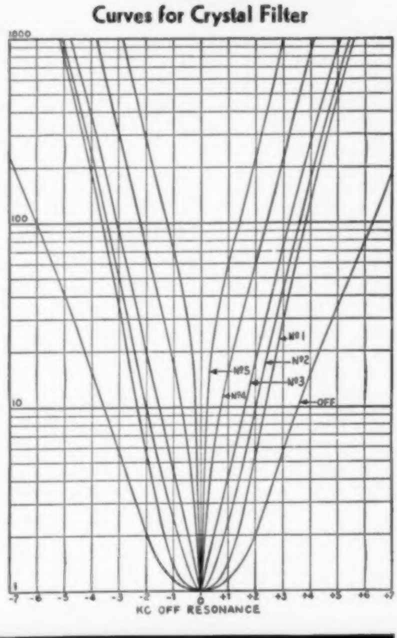
HQ-120 with *Full Range* CRYSTAL FILTER

THE NEW "HQ-120" with its "full range" crystal filter (see page 33 of December *QST*) splits crowded amateur phone bands wide open. This exclusive Hammarlund feature solves the phoneman's age-old problem of QRM from heterodynes and side-band splashover. The selectivity curves shown in the drawing were taken on a production model receiver. Labeling of these curves corresponds to the markings of the selectivity switch on the panel. In practice, curve No. 1 is not only wide enough to permit excellent voice reception, but fairly good quality music as well. Curve No. 2 is intended for voice reception where quality is a consideration even though QRM may be very heavy. Number 3 is for extreme conditions of interference where "getting the message through" is more important than quality. Positions 4 and 5 are for CW code reception. Unlike most crystal filters, the output of this one is uniform throughout its selectivity range, and there is no interlocking of controls.

Special consideration has been given to the R.F. gain of the receiver in order that it will not require a stronger signal on 20 meters than on 80, for example, to read "S-9" on the meter. The "HQ-120" is also equipped with a noise limiter which follows the strength of the incoming signal and suppresses automobile ignition interference and similar disturbances. In order to maintain high efficiency with various types of antennas, the "HQ-120" has an antenna compensating control which assures maximum image rejection, maximum signal-to-noise ratio, and perfect circuit alignment at all times. There is a spread of 310 degrees for each amateur band from 80 to 10 meters, and the dial is calibrated in megacycles for these amateur bands. This means you no longer have to guess at the frequency of your own transmitter or of the one at the other end of the QSO. Write Dept. Q-1 for complete descriptive literature.

SEND FOR 16-PAGE BOOKLET!

Curves for Crystal Filter



HAMMARLUND MFG. CO., INC.

424-438 WEST 33rd ST., NEW YORK

CANADIAN OFFICE: 41 WEST AVE., NO., HAMILTON, ONT.

Standard Frequency Transmissions

Date	*Schedule*	*Station*	*Date*	*Schedule*	*Station*
Jan. 6	BB	W6XK	Feb. 3	BB	W6XK
	A	W9XAN		A	W9XAN
Jan. 7	BX	W6XK	Feb. 4	BX	W6XK
Jan. 8	C	W6XK	Feb. 5	C	W6XK
Jan. 13	A	W6XK	Feb. 10	A	W6XK
Jan. 20	A	W9XAN	Feb. 17	A	W9XAN
	B	W6XK		B	W6XK
Jan. 27	A	W9XAN	Feb. 24	A	W9XAN
	A	W6XK		A	W6XK

STANDARD FREQUENCY SCHEDULES

Time (p.m.)	*Sched. and Freq. (kc.) A*	*B*	*Time (p.m.)*	*Sched. and Freq. (kc.) BB*	*C*
8:00	3500	7100	4:00	7000	14,000
8:08	3600	7100	4:08	7100	14,100
8:16	3700	7200	4:16	7200	14,200
8:24	3800	7300	4:24	7300	14,300
8:32	3900		4:32		14.400
8:40	4000				

Time (a.m.)	*Sched. and Freq. (kc.) BX*
6:00	7000
6:08	7100
6:16	7200
6:24	7300

The time specified in the schedules is *local standard time at the transmitting station.* W9XAN uses Central Standard Time, and W6XK, Pacific Standard Time.

TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:

2 minutes—QST QST QST de (station call letters).

3 minutes—Characteristic letter of station followed by call letters and statement of frequency. The characteristic letter of W9XAN is "O"; and that of W6XK is "M."

1 minute—Statement of frequency in kilocycles and announcement of next frequency.

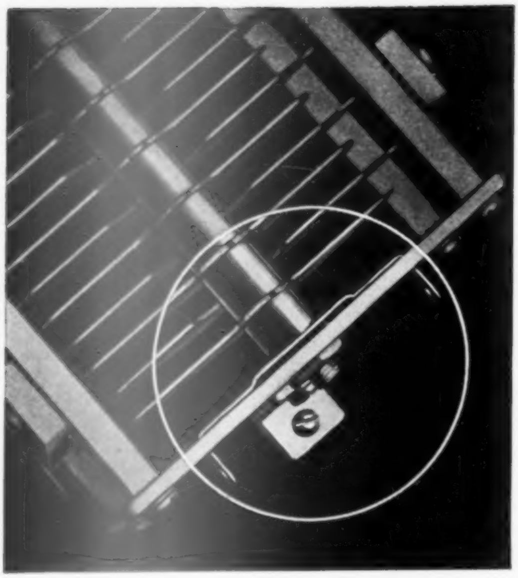
2 minutes—Time allowed to change to next frequency.

W9XAN: Elgin Observatory, Elgin National Watch Company, Elgin, Ill., Frank D. Urie in charge.

W6XK: Don Lee Broadcasting System, Los Angeles, Calif., Frank M. Kennedy in charge.

WWV Schedules

Each Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station, WWV, transmits with a power of 20 kw. on three carrier frequencies as follows: 10:00 to 11:30 A.M., E.S.T., on 5000 kc.; noon to 1:30 P.M., E.S.T., on 10,000 kc.; 2:00 to 3:30 P.M., E.S.T., on 20,000 kc. The Tuesday and Friday transmissions are unmodulated c.w. except for 1-second standard-time intervals consisting of short pulses with 1000-cycle modulation. On the Wednesday transmissions, the carrier is modulated 30% with a standard audio frequency of 1000 c.p.s. The standard musical pitch A = M440 c.p.s. is also transmitted from 4:00 P.M. to 2:00 A.M., E.S.T., daily except Saturdays and Sundays, on a carrier frequency of 5000 kc., power 1 kw., 100% modulation. The accuracy of the frequencies of the WWV transmissions is better than 1 part in 5,000,000.



Operating News

(Continued from page 75)

October '38 O.R.S.-O.P.S. Parties

The October O.R.S. and O.P.S. get-togethers were "humdingers," with splendid turn-outs and scores of unprecedented magnitude. New highs were established in both parties. Active qualified operators should get in on these enjoyable activities by lining up their stations with the O.R.S. or O.P.S. group. Write your S.C.M. *to-day*, if interested.

W3BES leads the O.R.S. gang for the second consecutive time and W8MBW "dittos" in the O.P.S. group—take a look at their records! W2JZX moved up into second place among O.P.S., with W1COI third. W8KUN, second high O.R.S., gave W3BES a close race, followed by W4NC with W4ABT operating. The next O.R.S. and O.P.S. Parties will be on January 28th–29th. Make your plans accordingly!

Official Relay Station Scores

Station	Score	Diff. Stat.	Diff. Sect.	No. Heard	Power	Section
W3BES	16,279,922	203	54	16	150–200	E. Pa.
W8KUN	16,115,042	210	57	41	100	W. Pa.
W4NC (4ABT, opr.)	13,585,500	194	56	22	800	N. C.
W6KFC	13,233,671	153	56	18	50–100	Ariz.
W1TS	12,757,525	200	53	—	350	Conn.
W8JTT	10,180,884	175	53	43	250	W. N. Y.
W2HMJ	8,890,980	163	47	8	250	N. Y. C. & L. I.
W4AGI	7,791,538	158	48	5	500	Georgia
W2HZY	7,546,922	151	51	26	100	N. N. J.
W1LLX	6,715,812	159	42	22	200	E. Mass.

Station	Score	Stat.	Sect.	Station	Score	Stat.	Sect.
W3GDI	6,251,265	146	43	W9ARE	4,835,922	131	4
W8CMH	5,971,158	142	44	W8LCN	4,592,820	118	57
W9KJY	5,708,968	134	50	W7FFQ	4,483,794	102	41
W1KQY	5,701,220	149	44	W7GEE	4,073,067	95	45
W3CHH	5,544,211	141	40	W3FPQ	3,907,464	127	36
W9VES	5,368,641	134	47	W3NF	3,868,805	118	47
W5EOE	5,336,988	125	47	W1EOB	3,391,704	115	35
W3DGM	5,233,943	147	40	W3ADE	3,169,026	108	38
W8MOT	5,130,876	132	45	W2GVZ	3,112,159	120	49
W9NFL	4,834,720	117	47	W2KXF	2,999,716	108	33
				VE3EF	2,996,448	110	38
							7

The score of W1AW, not competitive with any of the above, is recounted for the information of Members: W1AW (W1JTD opr.); 16,878,980; 210; 58; 31; 1,000.

Official 'Phone Station Scores

Station	Score	QSO's	Sections	Heard	Power Input	Section
W8MBW	9180	60	27	20	800	W. N. Y.
W2JZX	7100	50	25	17	700	N. Y. C. & L. I.
W1COI	6944*	49	26	18	40/400	W. Mass.
W9WXL	6288	42	24	26	85/200	Ky.
W1BNO	6118	48	23	13	500	W. Mass.
W3FGJ	5880	43	24	15	500	Va.
W4CYB	5880	48	21	20	500/250	N. C.
W1GZL	5094	35	18	54	50/300	W. Mass.
W8DSJ	4920	40	20	23	100/300	W. Va.
W8ICQ	4864	48	19	8	125/150	Ohio

Station	Score	QSO's	Sect.	Station	Score	QSO's	Sect.
W4DCQ/2	4370	38	19	W2DC	3675	31	21
W4CVQ	4360	26	20	W2DVC	3328	30	16
W8BHN	4340	43	20	W8PFM	3162	30	17
W9TTA	4097	41	17	W1DWP	3040	26	20
W8NNJ	3819	35	19	W5CXH	2924	20	17
W1EAO	3686	34	19	W3BRZ	2772	26	18
				VE3KM	2736	31	16

* 8 hours, 25 mins. Score of 7306 corrected to 8 hours.

MEMBERS, DX CENTURY CLUB

G6WY	(No. 5)... 141	W9GDH	(No. 41)... 109
W1TW	(No. 3)... 133	W9EF	(No. 44)... 109
W1SZ	(No. 7)... 132	W4CEN	(No. 60)... 109
W8DFH	(No. 14)... 131	W3EDP	(No. 53)... 108
W6CXW	(No. 4)... 130	W6HX	(No. 21)... 107
W6GRL	(No. 15)... 129	G6CL	(No. 24)... 107
W2GT	(No. 32)... 128	W2HHF	(No. 54)... 106
G2ZQ	(No. 6)... 127	W3EVW	(No. 55)... 106
W2GTZ	(No. 12)... 127	PAØXF	(No. 43)... 105
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W1TS	(No. 9)... 125	W9ADN	(No. 61)... 105
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W1LZ	(No. 10)... 121	W6FZL	(No. 48)... 104
W1BUX	(No. 2)... 118	W3EVT	(No. 51)... 104
W9KG	(No. 16)... 118	W8BKP	(No. 65)... 104
W8DHC	(No. 27)... 118	W3CHE	(No. 87)... 104
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W1DF	(No. 29)... 112	W2CJM	(No. 47)... 101
W8OQF	(No. 30)... 112	W2CYS	(No. 52)... 101
W9PST	(No. 35)... 112	VK3KX	(No. 57)... 101
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W6GAL	(No. 50)... 112	W1ZB	(No. 62)... 101
W4BPD	(No. 70)... 112	W3DDM	(No. 72)... 101
W1FH	(No. 71)... 112	W2OA	(No. 73)... 101
W7AMX	(No. 26)... 111	W3EPV	(No. 74)... 101
W2BHW	(No. 39)... 111	W4AJX	(No. 75)... 101
W8ADG	(No. 63)... 111	W6DOB	(No. 76)... 101
ON4UU	(No. 31)... 110	W9FS	(No. 77)... 101
W6ADP	(No. 34)... 110	W1DUK	(No. 82)... 101
J5CC	(No. 46)... 110	G5RV	(No. 64)... 100
W9TJ	(No. 67)... 110	VE2AX	(No. 84)... 100
W5VV	(No. 38)... 109	W3FRY	(No. 85)... 100

W2CBO (No. 86)... 100

The following have submitted proof of contacts with 75-or-more countries.

W2DSB	99	HB9X	89	Radiotelephone	
W8EUY	99	VE2EE	89	W2IXY	77
PAØQF	99	PAØQZ	88	W4CYU	75
W2ZA	98	W3JM	88	W3EMA	81
W3AG	98	W8DOD	88	W9FLH	81
W3GAU	98	W8NJP	88	W9RCQ	81
F8RR	97	G2DZ	88	W3BVN	80
W1CC	96	G2MI	88	W3EPR	80
W4DRD	95	W1GCX	87	W3GEH	80
W1GDY	94	W4CCH	87	W8DGP	80
W1ZI	93	W6ITH	87	LU7AZ	79
W6BAM	93	W8AAJ	87	SM6WL	79
W6GHU	93	W9AEH	87	W1EWD	78
W8BOX	93	W1HX	86	W2AER	78
G6GH	93	W3AIU	86	W8AAT	78
W1FTR	92	W9CWW	86	W8BFG	78
W2BYP	92	W1GNE	85	W8FJN	78
W8OXO	92	W2IOP	85	W8MTY	78
W1BGY	91	W4MR	85	W9UM	78
W3BES	91	W6FKZ	85	G6YR	78
FB8AB	91	W2GRG	84	VE2GA	78
G6NF	91	W3AGV	84	W1ICA	77
HB9BG	91	W3KT	84	W6KUT	77
W1RY	90	W4CFD	84	W6TT	77
W8KTW	90	W8BSF	84	W6LDJ	76
J2JJ	90	G5QY	84	W8LZK	76
SU1WM	90	VK6SA	84	G6XL	76
W1ADM	89	W5ASG	83	ZS2X	76
W3ZX	89	G6ZO	83	W3CKT	75
W5KC	89	SP1AR	83	W3FLH	75
W8AU	89	W2ALO	82	W4TZ	75
W8CJJ	89	W3OP	82	W6AM	75
W8KKG	89	W6GPB	82	W8DAE	75
G5BD	89	W9OVU	82	PAØJMW	75
		W1BFT	81		

Emergency Preparation Demonstrations

T. J. De Lasaux, A.R.R.L. Emergency Coördinator, San Francisco Section, is sponsoring demonstrations of the availability of amateur radio for emergency communication. On Sept. 24, 1938, in connection with the celebration of the opening of a new strip of highway, a fixed station was set up in the office of Marvelous Marin, Inc., and a portable emergency-powered transmitter and receiver was at the scene of the celebration. This made it possible for state and other civic officials to participate with full assurance that they could be reached at any time. In addition, the State Police Highway Patrol had its receiver tuned to the frequency used

by the amateurs (in the 1.75-Mc. band) in the event additional men were needed to handle the traffic situation. Those participating were W6SG, W6LQW, W6OMC, W6QGN and W6OBK.

On Oct. 24th another demonstration was given for the disaster committee of the American Legion in Marin County. Portable equipment was set up in the three A. L. posts, one at Mill Valley, Ross and San Anselmo. The three posts held a joint meeting by means of the hook-up. 1804 kc. was used and, with the coöperation of the Mission Trails Net, which monitored the frequency, there was little QRM. The demonstration was a success and there is a probability that the A. L. group will underwrite the securing of an emergency power supply, transmitter and receiver for each section of the county having a population of from 5000 to 10,000 inhabitants. Participating in this demonstration were W6FVK, W6HVX, W6KNZ, W6LQW, W6PAZ, W6QGN and W6SG. Also present and assisting were W6OBJ, Emergency Coördinator, East Bay Section, together with his two assistants, W6BF and W6OMC.

Wisconsin-Minnesota Sleet Storm

A sleet storm beginning the night of Oct. 21, 1938, and lasting through the 22d, turning to heavy slush snow, left sections of western and northern Wisconsin and southeastern Minnesota without power and communication facilities. Again amateur radio filled the breach. At 10:00 A.M. on the 22d, the Northern States Power Company asked W9DCM, Minneapolis, to contact Eau Claire, Wis., W9DCM made contact with W9IXR, Rice Lake, Wis., who made a long-distance telephone call on the last line that was standing, notifying the power company at Eau Claire to secure the aid of local amateurs. In a short time W9OKS and W9SKX of Eau Claire were in communication with W9BN and W9DCM of Minneapolis. W9AN, St. Croix, Wis., was also on the air giving service to the power company, contacting W9SKX, W9OSB and W9UVA to handle traffic in that area. Red Wing, Minn., was entirely out of communication and power service. W9DCM raised W9ORL of Red Wing and furnished that city with its sole contact through the 22d and 23d until regular service was restored. W9ORL was using a 7-watt battery-powered rig. W9FWN assisted at ORL. Through this contact, men and supplies were sent to Red Wing to assist in restoring power service. W9SYX was on hand throughout the emergency requesting non-participating stations to remain off the air to lessen the QRM, and assisting in relaying information. All of these stations, with the exception of W9BN, W9OKS and W9SKX were on 3.9-Mc. 'phone with W9DCM as the central station for clearing information to the power company office in Minneapolis.

On the 23d, W9JNU of Eau Claire took a portable out with a line crew to patrol ninety miles of transmission lines which were down in the stricken area, reporting breaks as they came to them. W9OKS acted as key station to keep the dispatcher at Eau Claire advised of the progress of the crew. On the morning of the 24th, W9DIT went into action with a line crew to patrol another section of line, approximately one hundred miles in length. The two portables were on the job with the crews until the repairs were completed and the crews sent home. W9JNU was powered with a Mallory power pack, and W9DIT with a genemotor, each using a storage battery for primary power. Each portable had an output of about 7 watts, crystal-controlled and operated 3.5-Mc. c.w., as did the key station, W9OKS. These operators are all members of the Northern Wisconsin Radio Club and welcomed the opportunity to be of service and demonstrate the effectiveness and reliability of amateur radio in emergencies.

With Cannon Falls, Minn., still without telephone service on the 23d, W9DH and W9DCM took portable equipment from W9BN, Minneapolis, to that city. Enroute over poor roads their receiver went bad and they called upon W9BQJ, Cannon Falls, who assisted them in locating another set. With the coöperation of W9BQJ, W9DH-portable was set up about twelve miles out of the city on the power company's line to Red Wing. Two 56-Mc. transceivers were used from the base station out on the line and information relayed into Cannon Falls to the power company's dispatcher. The c.c. portable transmitter consisting of a single 6A6 on 3890 kc. was powered by a six volt storage battery and a 350-volt generator.

W9GBL, La Crosse, Wis., was also on the job. The Michigan QMN Net on 3663 kc. was active throughout the emergency period, ready to assist in every way possible.

— *W9DCM, W9BN and W9OKS.*

Earthworm Sighs to 20 K.W.

WE ARE only human, fall in love, have grouches, and are bitten by bugs like anyone else. At the moment it's Q. and A. with us, so read on:

Q. What is a Metallized Resistor?

A. A Metallized Resistor consists of a very thin film of fine conducting particles bonded together on the surface of an insulating base.

Q. How thick is this film?

A. About as thick as the seat of our 2nd-best pants — one to three thousandths of an inch.

Q. How fine are these particles?

A. Of colloidal size — they are ground fine enough to float in air.

Q. Of what are these conducting particles made?

A. Carbon and other conducting materials.

Q. How are they bonded to this insulating base?

A. The conducting particles are deposited in a controlled film on the surface of the insulator. Successive treatments in high temperature conveyor ovens bond the particles together and to the insulating base. This stabilizes the film to prevent changes in resistance after the unit is completed. Needless to say, these processes have been continually improved and refined during the fifteen years we have made resistors.

Q. What is the insulating material on which this film is applied?

A. Glass, Isolantite or Steatite, and Bakelite. A special glass rod or tube, about the diameter of a pencil lead, is used in the High Frequency "F" Type and the Insulated "BT" Type Low-Power Resistors. The same is also used in the Types "FH" and "MG" Ultra High Range Resistors (up to 100,000 megohms). Isolantite or Steatite tubes are used as the base material for the Type "MP" High Frequency Power and the "MV" High Voltage Resistors.

A high grade bakelite is the material to which the metallized film is applied for volume controls.

Q. Wherein do these Metallized Resistors differ from the common carbon units?

A. The Metallized Resistor has a *conducting film of minute cross-section* compared to the solid body of the molded or extruded carbon resistor.

Q. And so . . . ?

A. The Metallized Resistor uses a conducting element of much lower specific resistance, or; *the proportion of conducting to non-conducting material is much greater.* This is the direct reason for the low noise level, and low voltage and temperature coefficients noted here in November.

Q. Will such a thin film carry power?

A. This is a matter of design. We manufacture Metallized Resistors that will handle anything from an earthworm's sigh up to 20 K.W. of R.F. (These latter units are water cooled, of course, and are about 3" diameter x 20" long.) Other low range Type "MP's" handle momentary surges of several thousand amperes.

Q. Will it handle voltage?

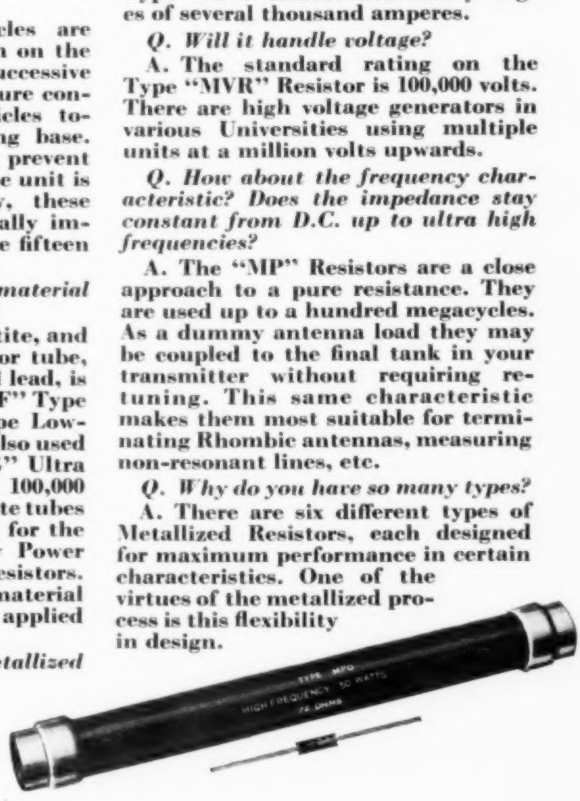
A. The standard rating on the Type "MVR" Resistor is 100,000 volts. There are high voltage generators in various Universities using multiple units at a million volts upwards.

Q. How about the frequency characteristic? Does the impedance stay constant from D.C. up to ultra high frequencies?

A. The "MP" Resistors are a close approach to a pure resistance. They are used up to a hundred megacycles. As a dummy antenna load they may be coupled to the final tank in your transmitter without requiring retuning. This same characteristic makes them most suitable for terminating Rhombic antennas, measuring non-resonant lines, etc.

Q. Why do you have so many types?

A. There are six different types of Metallized Resistors, each designed for maximum performance in certain characteristics. One of the virtues of the metallized process is this flexibility in design.



INTERNATIONAL RESISTANCE COMPANY • 401 NORTH BROAD STREET, PHILADELPHIA, PA.

ADVERTISEMENT

W1AW Operating Schedule

(Effective Dec. 27, 1938)

OPERATING-VISITING HOURS:

3:00 P.M.–3:00 A.M. daily, except Sat. & Sun.
Saturday — 8:30 P.M.–2:30 A.M.
Sunday — 7:00 P.M.–1:00 A.M.

GENERAL OPERATION:

W1AW devotes the following periods daily, except Saturday and Sunday, to *GENERAL work* with all amateurs in the following bands:

Band	*Frequency*	*Time — Eastern Standard*
1.8 Mc.	1808-1800-kc. 'phone/c.w.	3:00– 3:30 P.M. 11:00–11:30 P.M.
3.5 Mc.	3800-kc. c.w.	3:30– 4:00 P.M. 8:00– 8:30 P.M.
3.9 Mc.	3950-kc. 'phone	10:00–11:00 P.M.
7 Mc.	7150-kc. c.w.	1:00– 2:00 A.M.*
14 Mc.	14,254-kc. c.w.	6:00– 7:00 P.M.
14 Mc.	14,240-kc. 'phone	4:00– 5:00 P.M.

* Daily except Sun. & Mon.

On Saturdays W1AW is operated from 8:30 P.M. to 2:30 A.M. E.S.T., and on Sundays from 7:00 P.M. to 1:00 A.M. E.S.T. On these days operation will be devoted to the most profitable use of bands for general contacts and to participation in special week-end operating activities and contests. The station is not operated on legal national holidays.

OFFICIAL BROADCAST SCHEDULE (for sending addressed information to all radio amateurs):

Frequencies

C.W.: 1800–3800–7150–14,254 kcs. (simultaneously)

Starting Times (P.M.)				*Speeds (W.P.M.)*						
E.S.T.	*C.S.T.*	*M.S.T.*	*P.S.T.*	*M*	*T*	*W*	*Th*	*Fri*	*Sat*	*Sun*
8:30	7:30	6:30	5:30	20	15	25	15	20	—	20
Midnight	11:00	10:00	9:00	15	25	15	20	15	15	—

'PHONE: 1808, 3950, 14240 kcs.

Each code transmission will be followed in turn by voice transmission on each of the above frequencies.

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BRIEFS

1.75-Mc. Trans-Atlantic Tests, February 1939

The Annual 1.75-Mc. Trans-Atlantic Tests will be held this year in February under the guidance of G6FO. The object of the tests is to continue the observations and tests originally started in 1934 by G2II (now GW6AA), to endeavor to effect G-W QSO's on 1.75 Mc., to observe conditions obtaining on the band at the time and during the period which previous experience shows to be the best for contacts between U. S. A. and Europe, and to focus interest on the DX possibilities of our lowest frequency band.

A number of G stations, as well as many listeners, are interested in these tests. It is hoped that W operators using 1.75 Mc. will participate and keep the following schedule: 0430 to 0730 G.T. on each of these dates — February 4th, 6th, 8th, 10th, 12th, 14th and 16th. Calling and Listening Schedule: 0430–0440, W calls, G listens; 0440–0450, G calls, W listens; 0450–0500, W calls, G listens; and so on at ten-minute intervals until 0730 G.T. Accurate time-keeping is essential. All G stations will operate in the region 1720–1800 kcs., listening for W c.w. and 'phone stations in the complete "160-meter" band. Any QSO established should be kept short to give other stations an opportunity to make contact. All American participants are asked to send a log and report as soon as possible after the Tests to G6FO, 84–86, Tabernacle St., London, E. C. 2, England. Reports should also be sent to A.R.R.L. headquarters.

— *S. S. Perry, W1BB.*

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Addenda, Field Day Results

Received too late to make the December *QST* story on the 1938 A.R.R.L. Field Day was the report of the Jacksonville (Fla.) Radio Club. Operating W4DIQ-4 on 7 and 14-Mc. c.w. and 28- and 3.9-Mc. 'phone, the "Jax" gang made 501 points (33 QSO's). Operators were W4CRZ, W4BNK, W4EEM-W9QBU, W4EOE, W4EOS and W4DIQ.

The call of the Saskatoon Amateur Radio Club was erroneously listed in the F.D. scores as VE4AAW. The correct

TO OUR READERS

who are not

A.R.R.L. MEMBERS

WOULDN'T you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on page 6 of this issue. We should like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio. You will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below — clip it out and mail it today.

★

A bona fide interest in amateur radio is the only essential qualification for membership

AMERICAN RADIO RELAY LEAGUE
Hartford, Connecticut, U. S. A.

I hereby apply for membership in the American Radio Relay League, and enclose \$2.50 (\$3 in foreign countries) in payment of one year's dues, \$1.25 of which is for a subscription to *QST* for the same period. Please begin my subscription with the .... issue. Mail my Certificate of Membership and send *QST* to the following name and address.

....

....

....

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may send him a sample copy of *QST*?

....

Thanks

call is VE4AAA. Through an oversight the Jersey Shore Amateur Radio Association failed to mention W2HWX as a member of its F.D. party; HWX played an important part in W2AIW-2 operations.

Brass Pounders' League

(October 16th–November 15th)

Call	*Orig.*	*Del.*	*Rel.*	*Extra Del. Credit*	*Total*
W2CGG	29	318	1654	303	2304
W2JHB	391	490	703	473	2057
W4PL	21	64	1627	48	1760
W6IOX	15	15	782	11	823
W8KWA	32	63	642	0	737
W3CIZ	19	47	587	47	700
W6DH	61	112	364	112	649
W3EML	63	86	420	74	643
W1KZT	21	314	48	254	637
W8IXJ	138	21	472	2	633
W8QGD	88	137	282	99	606
W3BWT	51	82	359	63	555
W1KTH	541	13	0	0	554
W5FDR	42	122	278	108	550
W5MN	29	73	366	56	524
W5EOE	23	142	338	18	521
W9NFL	18	35	442	16	511
W1INU	66	35	408	0	509
W6LLW	9	40	434	22	505

MORE-THAN-ONE-OPERATOR STATIONS

Call	*Orig.*	*Del.*	*Rel.*	*Extra Del. Credit*	*Total*
KA1HR	709	480	890	0	2079
W5OW	154	166	1340	83	1743
W4CXY	941	10	0	0	951
W9BNT	54	147	368	17	586
W1GOJ	68	63	401	41	573

These stations "make" the B.P.L. with *total* of 500 or over. One hundred deliveries + Ex. Del. Credits also rate B.P.L. standing. The following one-operator stations make the B.P.L. on deliveries. Deliveries count!

W8CMH, 294	W6IMI, 161	W8FUW, 121
W6JTV, 229	W9TFA, 159	W5DAQ, 115
W9ESA, 224	W6ZX, 152	W6DKS, 114
W2OQ, 217	W3QP, 151	W8OFO, 108
W5DKR, 191	W1KIN, 148	W5GUK, 100
W7APS, 190	W5CEZ, 147	More-than-one-opr.
W6EJA, 186	W5BN, 135	W1AW, 372
W2SC, 178	W6MDI, 132	K5AA, 151
W9UKB, 166	W1AKS, 129	

A.A.R.S.

WLN (W2SC) made the B.P.L. *on 297 deliveries.*

MORE-THAN-ONE-OPERATOR STATIONS

Call	*Orig.*	*Del.*	*Rel.*	*Extra Del. Credit*	*Total*
WLM (W3CXL)	130	348	2857	74	3409

A total of 500 or more, or 100 *deliveries* Ex. D. Cr. will put *you* in line for a place in the B.P.L.

Third Annual South African DX Contest

AMATEURS throughout the world are invited to participate in the third S.A.R.R.L. International DX Contest to be held on the first and second week ends of January, 1939.

Dates: January 7th (1600 GMT) to January 8th (2200 GMT) and January 14th (1600 GMT) to January 15th (2200 GMT).

Bands: Any or all bands can be used. A station can be worked but once per band, per week end. Stations worked on the first week end can be worked on the second week end.

Exchanges: As usual, a six-figure group will be exchanged. The first three numbers will be the signal report; the last three numbers will be a self-assigned figure used throughout the contest.

Points: Two points may be claimed for "two-way" exchanges, one point for "one-way" exchange.

Zones: Stations outside the "Africas" will base their multipliers on the following zones: ZS1, ZS2, ZS3, ZS4, ZS5, ZS6, ZE, VQ2, VQ3, CR7, FB8, FR8, OQ5, ZN1, VQ8.

Scoring: DX stations outside of the African zone will compute their scores by multiplying the total number of contacts by the total number of African zones by the total number of points. For example: W9ARL contacts 38 sta-

tions in 10 African zones for 76 points. His score = 38 × 10 × 76 = 28,880 points.

Awards: The highest DX scorer will receive a miniature trophy and a certificate. The highest in each country (each district in U.S.A.) will receive a certificate.

Returns: Logs showing Date, Station, Time, Freq., Zone, Nr. Sent, Nr. Received, Points and Total should reach the S.A.R.R.L., P. O. Box 7028, Johannesburg, South Africa, not later than March 15, 1939.

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High Sweepstakes Scores

As this issue goes to press logs for the 1938 Sweepstakes Contest are arriving by the dozens each day . . . and some 700 have already been received. It is as yet impossible to give any *official* results, but we're passing along the "claimed results" of some of the higher scorers, since we know that all participants are anxious to receive this information. So far there has been no report of anyone working all Sections in the contest. The complete official results are scheduled for April *QST*. The tabulation following shows score, stations worked and section worked in each case:

C.W.T.

W3BES	84000–502–67
W6KFC	76500–450–68
W3CHH	74080–463–64
W2IOP	71998–482–62
W5KC	69500–422–67
W9RSO	69020–406–68
W9VKF	67235–397–68
W8OFN	66430–514–65
W2HMJ	65000–400–65
W1TS	62531–363–69
W7CMB	61556–369–67
W8OKC	60795–389–63
W1AW (Hal)	60720–460–66
W4APU	60095–357–68
W9WFS	57840–303–64
W2HZY	57165–368–62
W9MUX	57120–359–64
W8JTT	56695–333–68
W3ATR	56050–380–59
W8DOD	54019–325–67
W9ZAR	53156–338–63
W9AWP	52053–331–63
W8CMH	49995–303–66
VE2EP	49300–290–68
W1AVJ	49115–312–65
W3GAU	48669–301–65
W6QAP	48100–304–65
W9CWW	46398–277–67
W1KQY	46116–366–63
W5CWW	44000–277–64
W3FPQ	43710–354–62
W9ZMG	42319–310–55
W5ELE	41920–267–64
W3FMY	41856–328–64
VE3ES	41456–304–55
VE2DR	40800–273–60
W9AET	40031–263–61
W9MGN	38964–257–61
W1KFE	38480–300–65
W6MEK	38132–256–62
W8AVB	37818–291–66
W9WTW	37620–316–60
W2JJE	36600–246–60
W9YXO	36409–304–59
W3GKL	35409–304–59

'Phone

W6ITH	45126–327–69
W2JUJ	17820–168–54
W9YQN	17280–160–54
W9TTS	13888–125–56
VE3AIB	13475–123–44
W9TQL	12960–152–36
W9UYD	12584–123–52
VE5FZ	12514–110–47
W9ZTO	11040–115–48
W6EJC	10608–102–52
W4CDG	10368– 97–54
W9GDB	10125– 91–50
W6AM	9447–100–47
W9WXL	7898– 81–39
VE4WJ	7556– 79–39
W8JAH	7490– 85–44
W5FDQ	7264– 75–39
W1GKJ	6665– 63–43
W4BQE	5719– 67–43

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S. C. Tornado Emergency

A tornado hit Charleston, S. C., about 8:20 A.M., September 29, 1938, leaving the city without power and with but one telephone line that was highly overtaxed by folks who were trying to communicate with their loved ones, friends or places of business.

The city being without power naturally handicapped the amateurs who were without the necessary emergency equipment. (A lesson on why we should all have auxiliary equipment!) However, the power company did restore power to the rural districts near the edge of the city, and that enabled W4FFH to put his 7-Mc. rig on the air around 11:00 A.M. As soon as the flying débris had settled, the amateurs of Charleston set about doing the best they could to start an emergency circuit. A portable battery-powered rig owned by W4CUS was loaned to the City Police department so that they could keep in contact with the police force and direct rescue work. CUS aided by FFH then returned to Follet Beach to bring CUS' rig to the city, that it might be set up at the car barn sub station where an attempt was being made to secure a line from the power plant which would give 110 volts a.c. This rig was turned over to the N.C.R. members, W4DHT, W4DBK, W4EOR,

W4DFC, W4EXP and W4FND. CUS then went to the home of FFH and, with W4CYT, aided FFH in the delivery of messages and collection of those to be transmitted. W4CUS later took control of his station which he had left with the N.C.R. group. At about 10:30 P.M. contact had been made and traffic started moving over the South Carolina 1.75-Mc. 'Phone Net. This work continued until 3:30 A.M., when time was taken out for a little shut-eye and a return to the air early in the day to complete the job of delivering and transmitting the rest of the traffic. CUS was aided by FFH and CYT in his late hour operation.

South Carolina amateurs taking part in the 1.75-Mc. circuit were W4EOZ, W4EDQ, W4BZX, W4DQY, W4ETF, W4EGH, W4EZF and W4EJK. These 1.75-Mc. fellows had been guarding the frequency of W4CUS in Charleston a long time before he was able to get his station on the air, keeping the channel clear.

3.5-Mc. operations: As soon as the fact that the tornado had almost isolated Charleston was known the 3.5-Mc. c.w. gang began a movement to construct an emergency circuit. Efforts to contact the Charleston fellows on 3.5 Mc. proved futile until about 7:00 P.M., when W4CWN at Fort Moultrie came on and was immediately contacted by W4BQE (with W4DNR, E.C.) at the key. CWN was aided by W4BNB and the following fellows about the Fort who aided in the deliveries, etc.: George C. Monts, Erwin Cathcart, R. E. Wentz, Jr., Paul McMichen, J. D. Bradley, Jake Lee Garbade, Robert E. Harring and J. A. B. Wentz. CWN is a government operator and, after about two or three hours of operation, it was necessary for him to return to the government frequency. W4BRF set about to secure the necessary batteries to enable W4CZN to put his portable rig on the air and continue the good work of CWN. CZN was aided in his operation by W4CZA. South Carolina fellows known to have taken part in the emergency work on 3.5 Mc. were W4BDT, W4CQU, W4EWB, W4BQE, W4EXJ and W4DNR. W4IR of College Park, Ga., also assisted. W5DAQ of New Orleans, Louisiana Emergency Coördinator, put some traffic into Charleston via W4CZN and made deliveries of replies within a few hours.

— *Ted Ferguson, W4BQE, S.C.M., S. C.*

O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October *QST* (page 71): W2CHK, W2JZX, W4BMM, W5FDR, W5GDU, W6IGO, W6KEO, VE4AA.

BRIEFS

Flea Power Defined

"A new type of high power is now becoming prevalent in the Chicago and nearby town areas. Kilowatt stations are becoming numerous, and a new club has been formed. It is called 'The Flea Power Club' and at this writing there are twenty-one members, each of whom operates a rig at an input of five watts or less. Perhaps you have wondered about the high power heretofore mentioned. Well, you have it . . . one watt is the equivalent of 200 flea-power watts; therefore, five watts makes a kilowatt flea-power station!"

— *"The Oscillator," official publication, Tri-Town Radio Club.*

W6USA

W6USA, amateur station at the Golden Gate International Exposition, on Treasure Island, San Francisco Bay, will be in operation soon. A very attractive souvenir QSL card will be sent for each QSO.

Broadcast station KPAB, Laredo, Texas, plans a series of DX programs directed to radio amateurs, running from January 15th to February 7th at around 2:00 to 3:00 A.M. CST. In addition to the usual acknowledgments KPAB will send to each individual reporting reception a souvenir of the Mexican border. These souvenirs will consist of such items as Mexican Sombreros, Mexican Sarapes, pottery, dressed fleas, jumping beans, feather pictures, miniature figures and many other characteristic Mexican handiwork pieces.

The South Florida Radio Association of Miami held its annual Portable Field Contest on October 16th. Winners were W4AII, W4PBP and W4DUW. Operation was in the 3.9-, 3.5- and 1.75-Mc. bands, c.w. and 'phone, with portable-emergency equipment. Scoring was based upon points received for contacts at no less than one mile distance and exchange of number groups with other portables and the two base stations, W4EDD and W4DRD. Power inputs ranged from 3 to 50 watts, and net scores were obtained by the division of the gross score by the square root of the input power.

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The first meeting (in person) of the Susquehanna Emergency Net was held at the Safe Harbor Power Plant of the Pennsylvania Water & Power Co., on Labor Day, 1938. Arrangements were in charge of A.R.R.L. Emergency Coördinator Charles Landis, W3UA, Mrs. Landis acting as host for the ladies. The gathering was addressed by Mr. Walter Wesselius, Asst. Director Relief, American Red Cross (Washington, D. C.), and Mr. Francis Farquhar of York, Pa., Chapter of the Red Cross on the necessity for communications, accuracy, etc., during emergencies. Other speakers were Mr. C. P. Merriam of Pennsylvania Water & Power, and A.R.R.L. Atlantic Division Director "Brad" Martin, W3QV. W3ZD and W8AVD demonstrated emergency equipment and told of their experiences in operating A.E.C. gear. An open forum discussion of net matters led to a better understanding of problems. Dinner was served, and a trip through the power plant made for an enjoyable and instructive day for all present.

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Amateurs again were called upon to provide communication in the North Park Boat Races, Pittsburgh, in connection with the Allegheny County Sesqui-Centennial Celebration. The number of entrants and drivers being doubled over the previous year, more time was necessary and more work for the radio crew. To eliminate some difficulties of previous experiences, the bulk of the work between the judges' stand and the boat house was carried on cross-band on 3.9- and 14-Mc. 'phone. The races covered two days, September 3rd–4th, 1938, with an attendance of over 250,000 people. 56-Mc. 'phone was used to provide communication between the crash boats and the judges' stand and boat house. This frequency was also kept as an emergency stand-by channel. Amateurs participating were W8OLW, OC, FTY, ONW, OFO, CUG, UK, BSO, CFR, AMP and NDP.

Lloyd M. Demrick, W6HJX, in charge of radio with the Andean Anthropological Expedition, Inc. The small unit pictured is one of two portable rigs to be used for contact between field parties and the base station. The transmitter runs 35 watts input on c.w. and uses a 6C5 for grid-leak modulation; oscillator is an 802 e.c.o. The receiver is a two-tube regenerative using a 6J7 and 6C5. Plug-in coils are used throughout. For further details on the Expedition see page 46, December *QST*. Call letters probably will not be issued until the preliminary party arrives in Ecuador. Frequencies applied for include all the amateur bands and three channels for 'phone, one each in the neighborhood of 19, 35 and 50 meters. Further information will be presented in *QST* as available.

Station Activities

DAKOTA DIVISION

FIFTH ANNUAL DAKOTA DIVISION QSO PARTY

The Fifth Annual Dakota Division QSO Party will be held from Friday, Jan. 13th, at 6 P.M. C.S.T. to Sunday, Jan. 15th, at midnight C.S.T. All amateur stations within the Division (North Dakota, South Dakota and Minnesota) are eligible to compete. There are no restrictions as to power, c.w., 'phone, or the bands used. The object will be to work as many stations outside of your own city in the Dakota Division as possible.

Score five points for each QSO with a Dakota Division station, and each station heard but not worked counts one point. The station must be located outside of your own city to count. The total points made are then multiplied by the number of sections worked. There are four sections, so the largest multiplier will be four.

At the conclusion of contest, tabulate your results, listing stations worked and heard, their calls, QTH and time, and mail to your S.C.M. within ten days.

The calling procedure will be CQ DAK CQ DAK CQ DAK DE W9 —.

The Southern Minnesota Radio Association donated a silver cup three years ago. This will go to winning station. The station winning the cup three successive years gains permanent possession of it. W9ATP is the present holder. Other prizes will be given to high scores in each Section.

Let's see a big turn-out for this party. It should be a lot of fun. Please remember to mail your results whether your score is large or small.

— *Edwin Wicklund, W9IGZ,*
S.C.M. No. Minn.

NORTH DAKOTA — SCM, Ernest E. Bloch, W9RZA — DYA reports from U. S. Airway Communications Station at Dillon, Mont. — pounds brass at 7FWS (ex-9OSN of Lidgerwood). While this is being written the ham bands are buzzing at Grand Forks, due to the Club W.A.S. contest. ZTL has new W.A.S. certificate. DM was awarded a Medal of Recognition of Service by the Lake Agassiz Council of Boy Scouts. Congrats to both you fellows. All amateurs who have emergency equipment are urged to register their equipment and become members of the A.R.R.L. Emergency Corps. Application blanks can be obtained from your S.C.M. The Army Amateur Radio System Net in North Dakota needs more members (especially in eastern part). For information and application blanks, write A.A.R.S., Signal Office, Federal Bldg., Omaha, Nebr. Note details of Dakota Division QSO Party in this issue.

Traffic: W9RZA 71 WWL 60 ZTL 6 NAW-WLI-YCJ-YJK 2.

SOUTH DAKOTA — SCM, A. L. Russell, W9VOD — IQD and SEB are new E.C.'s for Huron and Pierre. With WZH as net control, the 1.75-Mc. 'Phone Net opened with LLG, OQQ, GLK, JBT, SGI and CMJ as charter members. The gang meets Wednesdays at 11:30 P.M. C.S.T., and the latch string is out for one and all. ZMW is back from North Dakota. SRX is soundproofing his rig — from the neighbors' angle. IQZ has a new QTH. ZCC is new trunkliner. ZYD is new A.A.R.S. member. WLP is putting the finishing touches to a new rig. YJX is new district N.C.R. commander. ADJ's new rotary beam on 14 Mc. snared W.A.C. for him by knocking over four Africans in one night. YKY put up a 28-Mc. vertical. YOB hooked a K6 in SS. KNV's new rig is working hot on 7 Mc. CJC is moving to the sixth district; has built a mobile 28-14-Mc. 'phone job for the trip. OXC visited the Rapid City gang at a club meeting. It's a boy at VOD's, which is considerable consolation for a stolen car; the line for cigars forms on the right. Those traffic reports look good this month, gang!

Traffic: W9SEB 222 VQN 58 FOQ 55 ZCC-ZYD 21 WPA 15 IQZ 14 YOB 8 VOD 6.

NORTHERN MINNESOTA — SCM, Edwin L. Wicklund, W9IGZ — HEN, with JID as Alternate, has Trunk Line "A" perking 100% through Minn. VVA uses a pair of 203's to modulate his T200; he runs up to 700 watts input on 14-Mc. 'phone. LZT, new ham at Willmar, is using a 6L6 osc. HEO is rebuilding, a pair of 54's in 28 and 14-Mc. rig, a 203HD in the low-frequency rig. YAP rebuilt his power supply, fixing it so break-in or push-to-talk can be used. WDA is on 56 and 28-Mc. 'phone. QVP is using grid modulation on 28 Mc. YAP and IGZ dropped in on YVF for a visit, and to see his new 100-watt rig. IFW is using T40 on 7, 3.5 and 14 Mc. QNI and QPG have new Howard receivers. VUZ and YTL are on 28-Mc. 'phone. The S.C.M.'s of Dak. Div. and the Director, MZN, are on 3800 kc. every Sunday at 5 P.M. Get on and meet your fellow hams in the Division in the QSO Party, Jan. 13th–15th. C U there.

Traffic: W9HEN 212 FTJ 5 VEV 25 QPZ 16 UKB 254 SKT (ZYG) 4 IGZ 2.

SOUTHERN MINNESOTA — SCM, Millard L. Bender, W9YNQ — The annual convention of the S.M.R.A. was a great success. BP gave a good demonstration of ultra-short waves. YNQ let the OW win a prize too. VRY has a Jr. op. KUI is settled in new QTH at Preston. WAO and LCT are disgusted about that Illinois bootlegger. That call supposedly made for medical aid was heard on the West Coast on 3.5 as well as 1.75 Mc. The inspectors in Chicago are working on it. TPZ and UPO are really knocking off the DX on 14-Mc. 'phone. WDL finally has 150-watt 'phone on 1.75 Mc. The MN Net of the A.A.R.S. works like a veteran outfit. FNK has been in the hospital, seriously ill. MZN spends most of his time rag chewing. DCM was busy Oct. 22d–23d with emergency work when a sleet storm struck the central and eastern parts of Minnesota, extending into Wisconsin. Many localities were without light and communication. LCT has the Minnesota A.R.R.L. Net all lined up. It has a large membership, and will be able to handle a large amount of traffic. CVH is new O.R.S. Send in the news, fellows, and let's make these reports interesting.

Traffic: W9YNQ 42 LCT 6 MZN 3.

MIDWEST DIVISION

IOWA — SCM, Clyde C. Richelieu, W9ARE — LCX is experimenting with antennas and doing FB job as A.A.R.S. N.C.S. DUA is new O.R.S. and R.M. ZQW comments on FB O.R.S. Party, also copied Navy Day message. AWH rebuilt and has very reliable station. WTD is new O.P.S. in Burlington. PJR works E.C. Net from his various QTH's as Toll Line man for Bell Tel. — his pair of '45's eclipse all crystal jobs for quality and reliability. LAC is experimenting with beams on 28 Mc. QVA ran up nice score in SS. WMP was also in SS. WNL is oscillating as usual. NLA burned hole in big rack and panel job with 15 amperes antenna current. FSH is back on with '03A and TZ40's and is doing FB on 3.9-Mc. 'phone. ARE is putting up rotary beam. QOQ is putting in high power and experimenting with sub-harmonics. Let's get going on emergency work — if in need of assistance, write to your S.C.M. who can furnish folders covering emergency operation, etc. More reports are requested for next month and more club activity. TIH has new 8JK rotatable on 28-Mc. 'phone. QVZ has worked all states.

Traffic: W9LCX 316 DUA 33 ZQW 145 AWH 33 ARE 56.

KANSAS — SCM, Melvin D. Kirby, W9UEG — Please mail all activity reports to your new S.C.M., located in Arlington. VRZ and KUZ handled important traffic for Western Telephone Company during a recent sleet and ice storm. ZFS reports new layout with Eimac 100TH in final. WIN is modernizing WEK and operates on Trunk Line "H." VRZ and UEG were visitors at the Wichita Amateur Radio Club. BEZ has been reappointed Official Observer. All O.R.S. and O.P.S. please check your certificates for expiration dates.

Traffic: W9UEG 119 WIN 62 ZFS 2.

MISSOURI — SCM, Letha Allendorf, W9OUD — The Central Missouri A.R.C. is now affiliated with A.R.R.L. The Ozark Empire Radio Ass'n. is progressing rapidly. QMD applied for O.R.S. QXO is doing grand work on State Net. ZVA, KIK, NSU, QCO and VZQ are active in the net. under joint management of PYD and OUD. EEE at Missouri School of Mines, Rolla, is lining up schedules for student traffic. KEF has been operating on 14 Mc., using half-wave vertical, 30-watt carrier out of 120 watts to pair of RK-20's. VMH still schedules QXO and plays checkers. KEI is back on T.L. "E." OJL is new A.A.R.S. member. HVT is still calling DX. RSO has worked 87 countries and

wants to contact other Missouri DXers. KLJ has been ill and is operating from a reclining position. WIN in Wichita is alternating for OUD on T.L. "B." PYF is holding down job on T.L. "K." Some of you fellows have forgotten that S.C.M.'s are not mind readers. Doncha like to see your name in the paper? 73.

Traffic: **W9**OUD 291 PYF 145 QXO 94 KEI 73 RSO 35 KIK 19 RJP 17 VMH 16 ZVS 10.

NEBRASKA — SCM, Samuel C. Wallace, W9FAM — FAM reports Trunk Line "L" working through in very good shape now, and DI says the same for Trunk Line "B." KPA is shootin' the "bull" on Army Stage Net frequency. ZOO reports that old EWO of Kearney finally got back on the air. EHW operates on both 'phone and c.w., 1.75, 3.5 and 7 Mc. YDZ reports for the gang up his way. YDZ and GFI were in the SS. QQJ and BZR are rebuilding. VQO put up a 65-ft. vertical with aid of BZR, GFI and YDZ. Nine members of the Northeast Nebraska Radio Club attended Midwest Convention en masse. MPY and GUT got their NC-44. YHN is going to University. It is whispered that WGL and JED of Wayne swapped rigs. WWY of Sioux City visited YDZ. SDL is reporting on A.A.R.S. Net. FFF found very good turnout for the SS; most of his operation was on 14 Mc. WKP reports on emergency net operations: "The emergency drill worked very FB. My station was control of the Southeast Nebraska Net. We gave a short talk on operating nets and handling traffic, then called each station. These stations were in the drill: QMY, Lincoln; GYM, Union; EHW, Weeping Water; ZNI, Waverly; DI, Tobias; AFH, Rock Port, Mo.; IXB, Hamberg, Ia.; GIR, Peru, Nebr.; NMD, St. Joe, Mo.; SUS, Auburn, Nebr.; ZGX, Craig, Mo.; WYH, Unadilla, Nebr.; OWR, Nebraska City, Nebr.; ZPZ-VKT, BZV, Omaha; and CCX, Council Bluffs, Ia. Almost every one of these fellows has emergency equipment ready to go. ZPZ of Omaha gave a good demonstration of their inner city net. He operated on 1.75 Mc. and rest of gang on 56 Mc., ZPZ relaying all 56-Mc. stations to my station, WKP, for reports. I feel sure that in case of an emergency in Southeastern Nebraska we could handle the situation one hundred per cent. Will soon have the gang on a spot frequency." The Southeastern Nebraska Radio Club held meeting at WKP's home; the club is building a complete portable station, call ZVZ. AFH, ZGX and WKP have been holding schedule with LON, Rochester, Minn. DLK has new Sky Buddy on road. QMY has new speech equipment. JFJ has been working FB DX on 7 Mc. QHV drew portable transmitter at Midwest Convention! AFH got some filter condensers. GMX got an 809. SUS is back on the air after moving. RUJ has worked all continents. ZCF is busy handling traffic.

Traffic: **W9**BNT 586 (WLU 301) FAM 279 DI 122 KPA 120 ZOO 21 EHW 17 SDL 5 ZFC 107.

CENTRAL DIVISION

ILLINOIS — SCM, Leslie M. Dickson, W9RMN — Boss Dickson decided to take off a couple of weeks from the worries of the S.C.M. duties, so this is being dashed off by your former scribe, KJY. BEN is joining A.A.R.S. NFL and his peanut tube make the B.P.L. When moving to winter quarters, TZQ dropped his receiver! ATS is much interested in a 'phone traffic net. Hamfesters in Chicago are doing nicely with TFA as club station, as well as holding traffic contests. HQH is experimenting with new exciter unit, e.c., crystal or tri-tet. Absence of VS from State Net periods is due to trying to teach cryptography. VSX is out for O.P.S. School station ZXR is operated mostly by WJX. ACU has new frequency meter. First report from QMO in Mt. Sterling advises only three more states for W.A.S. after eight months on the air. CZS has worked 29 states with his 6L6 oscillator. UIJ and wife threw a Halloween party with local amateurs and spouses as guests; MLJ was among those present. New frequency-meter-monitor at SKR. Thanks to NFL and the net gang for help in rounding up reports. NHF wants to see more 3.9-Mc. 'phones in the Army Nets. Cahokia Radio Club of E. St. Louis is going along fine, reports EBX, with meetings second and fourth Wednesday; contact him if interested. RK-49 is perking nicely for PGB. KJY is building himself a nice place in the basement strictly for radio; separate transmitters for 3.5 and 7 Mc., and another for all-band operation.

Traffic: **W9**NFL 511 EBX 413 YDJ 245 HPG 176 (WLTI 73) MRQ 171 TFA 175 TUV 111 VEE 81 (WLTO 10) TZQ 67 DDO 64 BEN 57 VSX 36 VS 34 IMB 26 RVI 24 KJY 22 FOC 21 BRY 11 HQH 9 ATS 8 NXD-QMO 5 ACU 4 WJX-PGB 2.

INDIANA — SCM, Noble Burkhart, W9QG — AB is building V beam. AEB is back on with small rig on 7 Mc. AKJ is on 'phone with grid modulated T200. BQH is on 14 and 28 Mc. DET thinks his "QSL 40" rig is working fine. DHM is back on 14 Mc. after several years of inactivity. EGQ, after six years unsuccessful calling, finally worked three "J's" in one day. EIJ visited a couple of hams in Ft. Wayne. GOE has extended double Zepp. HUV worked 79th country. ILC was in SS. JHQ finally got back on. KBL in SS with 23 watts, got S7 from Calif. KGD is new ham in Covington. KPD is building new station. LG has new transmitter nearly finished. LJQ moved to Kokomo. LMX is trying to modulate a T20. MCH is going to town on 1.75 Mc. MDL spends most of his operating time handling traffic. MJN is new Gary ham. MLX is on 14 Mc. MYL is fooling with mobile 28-Mc. rig. NAA finally got pole straightened after being bent about a year. NGS is experimenting with low power emergency rig. PQL is working at Knox. PWZ reports that Ft. Wayne has 6 rotary beams. QG uses two receivers. QOV of Linton is on 1.75 Mc. SVH is new Emergency Coördinator. SVJ is going on 'phone. SVV is going to town in N.C.R. SYJ has new skywire and concentric cable. TRN has new 28- and 14-Mc. rig ready for the air. TTA is operating at new QTH — his card mailed from Hartford, Conn.! UNS worked first African for 4th continent on 28-Mc. 'phone. VMG operates on State 'Phone Net. VYC is on 7 and 14 Mc. WDV has new field strength meter. YWE is state reporter for A.A.R.S. ZBR has 5 continents. ZHL is on 28-Mc. 'phone. ZNC put up two new transmitter antennas for SS. New officers in Ft. Wayne Radio Club: YQV, pres.; DBJ, vice-pres.; VMG, secy.; TBM, communications mgr. New officers at Elkhart: DVE, pres.; FNP, treas.; SVH, A. M.

Traffic: **W9**AB 15 AXH 2 FWS 34 JHQ 3 KBL 1 LDV 51 MDL 22 NGS 20 QG 186 (WLHL 194) SYJ 24 TBM 146 (WLHW 32) VMG 6 YWE 61 ZNC 2.

KENTUCKY — SCM, Darrell A. Downard, W9ARU — Judging from number of stations participating in Ky. QSO Party of Nov. 13th, a good time was expected and evidently had by all. TXC uses a "rubber crystal" on his operating table for quick QSY's. NEP is now O.R.S. BEW is lining up E.C. stations in his area. ZJS turned over KYN schedule to QDZ, due to vacation. EDQ works schedules only and has a pile of them. TLZ and NAR have new directional rotating beams. The Ky. QSO Party brought some of the "unheard of recently" boys back on the air — NKD, VBM, TKP and GAQ. IFM, JRM, KKG and LXF all live in the Green Tree Manor Apartments! EQO was among those present at recent A.R.T.S. meeting. AYH served as President of A.R.T.S. during past year in his characteristic, efficient manner. CNE and ARU anticipate taking their emergency transmitters and receivers with them to the next bridge party, especially during SS contests. YQN can't keep from saying "SS" after CQ. Emergency Coördinator appointments are still open in numerous areas. Please write S.C.M. for appointment in your vicinity.

Traffic: **W9**EDQ 219 ARU 152 HAX 110 UKD 72 ALR 65 CDA 49 NEP 30 BEW 28 AUH 20 ZJS 18 KWO 15.

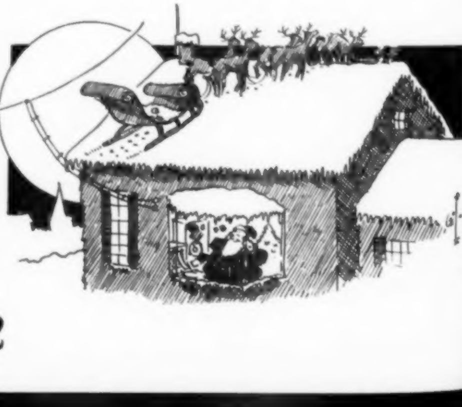
MICHIGAN — SCM, Harold C. Bird, W8DPE — On Saturday night, Oct. 23, the Michigan QMN Net received a radio report from the upper Peninsula that a heavy snow and sleet storm was raging and most of the phone lines and telegraph circuits were down. The first report the S.C.M. had was by wire from the Detroit wirechief. He immediately got 8BRS on the phone and was kept in constant touch with the situation until able to operate his own station. In the meantime 9CWR, 9GJX, 9FPK, 9SDG, 8PLC, JUQ, QGD, AKN, BRS, DYH, JZD and others, working in shifts, kept the QMN Net open. The Net kept continuous watch during entire night and all day Sunday and did not discontinue until a report was received that some of the phone lines were restored and telegraph lines were working normally. The QMN Net was prepared and is preparing more and more for EMERGENCY. Fine business, gang, and let's continue this good work. Your fine coöperation was appreciated beyond words. Michigan Eights: RAE is trying to keep on QMN while attending college. FOV says SS was very fine. DYH is plugging along with QMN and QPO Nets. DED reports new station in Holland, SMO. CAT expects to have big rig going soon. CSL is doing his bit of rebuilding. NQS has new 7-Mc. antenna to snag DX. AIZ is doing nice work on QMN. PVK reports activities from Nat'l Guard station. DPE says let's all plug for O.R.S.-O.P.S. trophies. QZH had a fire in remote control panel. KNP can

(Continued on page 104)

A.R.R.L. QSL Bureau

For the convenience of its members, the League maintains a QSL-card forwarding system which operates through volunteer "District QSL Managers" in each of the nine United States and five Canadian districts. In order to secure such foreign cards as may be received for you, send your district manager a standard No. 10 *stamped* envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six-cents postage. Your own name and address go in the customary place on the face, and *your station call should be printed prominently in the upper left-hand corner.*

W1—J. T. Steiger, W1BGY, 35 Call Street, Willimansett, Mass.
W2—H. W. Yahnel, W2SN, Lake Ave., Helmetta, N. J.
W3—Maurice Downs, W3WU, 1311 Sheridan St., N. W., Washington, D. C.
W4—G. W. Hoke, W4DYB, 328 Mell Ave., N. E., Atlanta, Ga.
W5—E. H. Treadaway, W5DKR, 2749 Myrtle St., New Orleans, La.
W6—Horace Greer, W6TI, 414 Fairmount Ave., Oakland, Calif.
W7—Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
W9—Roy W. McCarty, W9KA, 11 South Michigan Ave., Villa Park, Ill.
VE1—L. J. Fader, VE1FQ, 125 Henry St., Halifax, N. S.
VE2—C. W. Skarstedt, VE2DR, 236 Elm Ave., Westmount, P. Q.
VE3—Bert Knowles, VE3QB, Lanark, Ont.
VE4—George Behrends, VE4RO, 186 Oakdean Blvd., St. James, Winnipeg, Manitoba.
VE5—H. R. Hough, VE5HR, 1785 First St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court 7, Santurce, Puerto Rico.
K5—Norman F. Miller, K5AF, 15th Air Base Squadron, Albrook Field, Canal Zone.
K6—James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu, T. H.
K7—Dean Williams, K7ELM, Box 2373, Juneau, Alaska.
KA—George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.



(*Continued from page 101*)

be heard on QMN. BMG, SS, VB, ARR, EHD, DOI, MCV and JAH report. HKT says Twin Cities Radio Council is now known as Southwest Michigan Radio Club. HUD sends his report from the east. SCS is going to try 'phone along with QMN. Congrats on field day work, MGQ. PVB is trying to ham in a very drafty garage. JZD is going to move shack to basement. AHV is plugging for an O.B.S. Hear rumors that FWU is going southward again this season. Hate to lose you, OM. CMH paid the S.C.M. a visit. FX reports 56-Mc. Net started there. FB. CXT is in A.A.R.S. NDL is trying to perk up the boys in Flint. NGC is doing his big bit for QMN. QGD made the B.P.L. Very FB, OM. PYT is going to join the Navy. NQ is putting T55's in the final. IFE took message while in Carleton, Mich., and when outside of Detroit relayed from his car to SS. CSG is back with very nice signal. IXJ reports by radio with a B.P.L. total. Nice going, kid. Michigan Nines: HSQ has a portable ready soon as he receives meters and will be pounding brass on 3.5 Mc. very soon. DSG wants E.C. appointment. CE is trying for W.A.S. on 14 Mc. Glad to report 9SDG, RQE and AIZ as new O.R.S. Thanks for the nice bunch of reports, gang, but let's have more. Do you want an Emergency Field Day to test your ability?

Traffic: **W8**QGD 606 IXJ 633 CMH 363 JZD/8 317 FTW 310 (WLTJ 72) AIZ 240 NGC 202 PLC 186 RVE 163 JUQ 137 DYH 114 BRS 95 RQE 66 DPE 53 FWU 44 ARR 43 DOI-PYT-BMG 42 SCS 38 PVB/8 37 FX 37 AHV 33 CAT 20 HUD 27 GUN 26 NDL 22 EHD 16 VB-CXT 13 OCC-RJC 11 RRE-ABH 7 JAH 6 CSG 10 PVK 9 DED 6 SS 4 HKT 3 KNP-NQ 2 IFE-QZH 1 W9SDG 63 CWR 24.

OHIO — SCM, E. H. Gibbs, W8AQ — Wind blew down sticks at HCS twice in one week. PIH snagged his 45th state in O.R.S. party — all on 3.5 Mc. with 10 watts. We welcome RFF of Cincinnati and LCW of Mingo Junction to ranks of O.R.S. PGI worked Nevada and now has W.A.S. LZE and NKU are in Regulars Net as well as A.A.R.S. PVX uses "QSL 40" for 1.75-Mc. net. Westlake Club in Cleveland is going strong and welcomes new members. Two new antennas went up at DWT. GAV sticks his fist into Regulars Net. BAH wants to know what has happened to a lot of the old-timer O.R.S. Drop us a line, gang. RVL got rig lined up for 14-Mc. Dx. MDU and HDN are on 14 Mc. with quite a few watts. ROX runs over 100 watts to his single '10 final. RTI moved to Cleveland from Buffalo. SJG added a 6L6 final and runs 60 watts on 28, 14 and 7 Mc. SCM, Cleveland, serves notice we have two S.C.M.'s in Ohio — hi! HEY of Piqua is attending Purdue and operates 8HEY/9 as well as 9YB. RIX got a kick out of SS. SCT made R.C.C. HRF has new receiver and new rotary beam for 14 Mc. New 28-Mc. vertical at EQN works DX. OYI, Akron, applied for O.P.S. KKH has new antenna coupler working O.K. When Toledo Waite High football team played Peabody, Mass., at Peabody, a play-by-play description was relayed by ham radio and announced over loudspeakers at Toledo field. Handling Toledo end were JEX, BZO, PYR, SCM, SNQ and OFW. FB, fellows! New rotary beam at KNF stood 60-mile wind O.K. JFC worked 17 countries in one day on 28 Mc. Lots of new equipment at PUN, including scope, TZ-40 modulators and bass suppressor. GMI claims credit as water boy at erection of KNF's rotary — hi! Doc has pair of TZ-40's in 28 and 14 Mc. MFV has gone to grid bias modulating his 250TH with good results. AIR and NFZ advocate more activity on 112 Mc. after new regs. come in; they get as good coverage on that band as on 56 Mc. The new rotary beam at OVL has been worth all the time and work put into it. FB. Welcome to PBX Cincinnati, as new O.P.S. New officers of G.C.A.R.A. of Cincinnati: BFB, pres.; JFC, vice-pres.; PBX, sec'y.; NDN, treas. New pair of T-40's in final at OZH. Every active ham in Ohio should be a member of the Emergency Corps, even if he has no emergency-powered equipment. Drop a postcard to the S.C.M. for application blanks *now* while you think of it.

Traffic: **W8**HCS 389 PIH 220 RFF 130 PGI-LZE 80 NKU-LVU 48 AQ-LCW 42 PVX 35 LVH 32 EQN 29 OYI 25 APC 19 KKH 11 JEX 10 DWT 8 KNF 7 JFC-PUN-GAV 6 LCY-BAH 6 CVZ-BYM-RVL 4 ROX-PNJ-RTI 3 GMI 1 GVX 7.

WISCONSIN — SCM, Aldrich C. Krones, W9UIT — The Milwaukee Club offered prizes and a cup for the highest SS scores and the total score for Milwaukee will be the biggest in history. UIT lost his 14-Mc. vertical in the middle of the SS and had to get the fire department to help clear away the wreckage. ZTP, active in State Net, is doing fine job delivering messages in Milwaukee. ESJ has been handling traffic on 14-Mc. 'phone. HSK is entering his seventh year of activity in traffic work. GWK and RQM bore down plenty in the SS. DDC is new O.P.S. at Brodhead. RNX rebuilt his transmitter and worked two South Africans in one evening. SZL is active in T.L. "J," C.A. Net and State Net. YXH is new O.R.S. at Sparta. The Wausau Club held its annual election Nov. 8, PRM elected pres.; ZTO, vice-pres.; RLB, treas., QJB, secy. The N.W.R.C. meets the last Tuesday of every month. SKX is building new transmitter with T-125 final. DNB is working 28 and 14 Mc. with new Thordarson all-band rig. GIT is installing pair of TZ-40's in class B. WNB is on all bands with a kw. rig. JNU and DIT are building emergency transmitters. HMX is putting new transmitter on 3.9 Mc. with HY-40 final. YCV has the DX bug on 14 Mc. QFL has had excellent results on 28 Mc. with new vertical. FVG is building new rig, P.P. '52 final. IXR will have new 400-watt rig going soon. The S.C.M. is still hungry for reports. Come on, gang, send 'em in! Have lots of E.C. certificates on hand with few takers. Wisconsin needs an emergency organization. It's up to you, fellows!

Traffic: **W9**SZL 89 (WLTF 30) (NCR 51) ZTP 71 HSK 24 (WLTD 26) ESJ 24 UIT 2.

ROCKY MOUNTAIN DIVISION

COLORADO—SCM, Glen Glasscock, W9FA—ZDZ is high in traffic—here's how it's done: One day service from Manila to Philadelphia via 3 different routes!! Plus A.A.R.S. schedules and a K5 in the bargain. ESA made the B.P.L. on deliveries; Ed has been working on a Reinartz exciter. KNZ worked YS2LR and to his surprise found it was ex-9IFD of Ft. Collins. YS2LR is on almost every morning between 6 and 7 A.M. MST, about 14,390 kc., and would like to contact any of Colo. gang. WJJ has his rotary working on 14 Mc. ECY runs O.B.S. schedules at 7:30 P.M. every Mon. and Wed. evening on 1945 kc. MDN visited GLI during vacation. SBB divides time between C.W. on 3.5 and 7 Mc. and 'phone on 1.8 Mc. EKQ is hitting the ball again on A.A.R.S. and traffic. RVW is rebuilding rig and putting up new sky hooks. TDR, WWB, WVZ and LQO are involved in the statewide A.A.R.S. traffic net. GDC is D.N.C.S. for Colo. A.A.R.S. 'phones. WTN has been working 56 Mc. DDF sends in list of Colo. A.A.R.S. 'phones, all working on 1945 kc.: GDC, DDF, HDU, WTN, ZJQ, ZXL, NSY, VQY, ECY and MGX. The P.P.A.R.A. made another trip to the Black Forest with emergency portable outfit, powered this time by a.c. generator driven by Durant motor. CYM is building 6F6-6L6-RK39 rig. FXQ is on for A.A.R.S. drills, built a new untuned osc. rig for local emergency work. JVR is getting out well on 28 Mc. LFE has no antenna at his new QTH, but works the local boys without it. NWQ sold the TZ40 and got a T55. ZXU gets out well on 3.5 and 7 Mc.; he is replacing T20 with TZ40. OUI is getting in his share of code practice these days with John Spitz, with hopes of hitting the ball on 3.5-Mc. c.w. IPH spent Thanksgiving at home with the OM and brought the second harmonic along (Jr. opr. to you!). IPH and YL at C.U. are working on one of the new G.R. type v.t. voltmeters. YL and IVT have been working on transmission line for the Reinartz rotary beam. PTI has new band switching exciter built and can go from 3.5 to 112 Mc. with the outfit. PWP and UYS have been reporting regularly for N.C.R. drills while at C.U. via SBB, who is also at C.U. MKN, FYY, RRS, DSD and MTE have been regular operators at QBI, N.C.R. headquarters in the Old Customs House. BTO and BYY have been working on new rotary 8JK beam at BTO's QTH. TSQ left for Kansas City to train for Braniff Airways job. Good luck, Don. WTW, UXN, TEJ and NLN have been regulars at the N.C.R. control station at National Guard Armory, Pueblo. APR is still worrying with transmission line for the vertical. SAU joined the ranks of O.P.S. Let's have more of them. Let's have more dope, gang. There are lots more active hams in Colorado.

Traffic: **W9**ZDZ 444 ESA 330 EKQ 320 LQO 123 TDR 120 (WLJS 18) WWB 56 HDU 54 TDS 46 DDF 42 WVZ 33 ZXL-JJU 30 WJJ 17 MGX 16 ECY 14 ZJQ 12 NSY 9 VQY-WTN 8 GDC 7.

UTAH-WYOMING—SCM, Ernest E. Parshall, W7CLG —6LLH, R.M. Utah. 7GEE, R.M. Wyoming. Utah: 6PKB joined the N.C.R., receiving instruction from GQC. The Utah A.R.C. is becoming very active under new officers: BUW, pres.; DZX, vice-pres.; PKB, Secy.-Treas. The club had a booth at the State Fair. OWV is building new super.

PGH wants to inform all interested that he is well along on the road to recovery from recent accident and wants to thank all those who wrote to him or visited him in person to cheer him up. (Glad you are recovering rapidly.—S.C.M.) FYR states that the Southern Pacific R. R. Co. desires amateurs in the territory which the company serves, to organize an emergency net; the Ogden amateurs are organizing the net. Wyoming: 7GEE is really working the old traffic, schedules Trunk Lines "E," "G," "H" and "L." GCO received O.R.S. certificate. HDS, new call in Cheyenne, is wife of EUZ. ABO is back on working the world on 3.5 Mc. with a 6L6 and a ten with 80 watts. GOH is keeping 28 Mc. hot. GHF works 1.75-Mc. 'phone occasionally. PLEASE send more reports!

Traffic: **W6**FYR 186 PGH 3 OWV 1 W7GEE 34 CLG 6. (Sept.–Oct.: **W7**GEE 57.)

WEST GULF DIVISION

NORTHERN TEXAS — SCM, Lee Hughes, W5DXA — FRE can give good service on Alaska, China and east coast traffic. DNE has bunch of good schedules. FAJ is on early mornings. GJW is new O.R.S. CHJ is working in the Traffic Net. BKH reports GEH, HJN, GUV, AAO and FQG active in N.C.R. EZY has new Sky Challenger. FMZ built emergency receiver. BAM liked the SS. AZB put up a pole. GTM reports for the N.T.A.C. Radio Club; active members: 5FXN, GTM, GUI, GVH, HBR and HJC; they are on 1.75-Mc. 'phone looking for the gang each even Wednesday. GPY has new rig for 1.75 and 28-Mc. 'phone with T125 final, 300 watts. HDG attended West Gulf Convention and is building T125 'phone rig for 1.75 and 28 Mc. EOG is papa of new Jr. operator. TY on 14 Mc. with 6 watts worked two J's, and two K6's. EVI has 250 watts on 1.75 Mc. HIP is on 1.75 Mc. with HK154. HCA in Ft. Worth gave the Kilocycle Club a big day at the park. GZH with 6-watt 'phone on 1.75 Mc. has worked all Districts except 1 and 2. EER, CJJ, EXW, GJX, MR, GSE, DRV and DAM are on 1.75 Mc. AJG and EHM are on 56 Mc. GCP has a Johnson Q on 14-Mc. 'phone. John Reinartz made a real ham talk at the Dallas Y.M.C.A. AQS has an 8JK beam. HCA has a new RME 20 db. FDD and BJ are on 14-Mc. 'phone. HIR is on 7 Mc. DXR is chief op. of police transmitter at McKinney. FCA, R.I., is on 7, 14 and 3.5 Mc. CEV has 101X receiver and HK54. EDB is rebuilding for 1.75 Mc. DAS has 148 watts on 14,164 kc. EVI has P.P. 100TH's on 14- and 28-Mc. 'phone. Merry Christmas and a Happy, Prosperous New Year to all.

Traffic: **W5**EOE 52 AUL 186 DXA 129 FRE 119 DNE 92 FAJ 82 GJW 32 CHJ 28 BKH-HFN 19 EZY 17 FMZ 15 FNP 22 DAS 8 BAM-AZB 5.

OKLAHOMA—SCM, Carter L. Simpson, W5CEZ—CEZ is now equipped with gas-engine-driven, 300-watt, 110-volt a.c. power for emergency or portable work. GME pinch hit for FSK, who was off clearing up harmonic trouble. YJ rustled up another recruit for A.A.R.S. in GFH. DTU is still batting 1.000 on A.A.R.S. drills. EGP has been unable to make all schedules regularly during illness and death of his sister. We all extend deepest sympathy to him and his family. CEB qualified for A.A.R.S. certificate and applied for N.C.R. enlistment along with GVV and GFT of Enid. DAK completed Navy Training Course for RM1C. GFH signed up with the A.A.R.S. GAQ resigned as 'Phone N.C.S. in A.A.R.S. and joined the C.W. Net. GZR qualified for A.A.R.S. certificate. GZU joined A.A.R.S. DBD, formerly of Oklahoma City, is operating at WBBZ, Ponca City. CFA and KZ are working in Ill. AIR visited the S.C.M. QL and CEB were other visitors at the S.C.M.'s shack. BJG has been off for past few weeks due to illness. Hope you get back with us soon, OM. GBY is with HQ 7th Signal Service at Ft. Sam Houston, Texas.

Traffic: **W5**CEZ 469 (WLJC 43) (HESC 64) GFT 139 (WLJE 24) GME 76 YJ 76 (WLJO 22) FOM 61 DTU 54 EGP 33 (WLJL 8) CEB 34 DAK 34 EXZ 18 GFH 35 EMD 14 GAQ 27 GZR 14 GZU 4.

SOUTHERN TEXAS — SCM, Dave H. Calk, W5BHO — The A.A.R.S. Nets and Southern Texas Nets are very active. OW leads in traffic with a large total, FDR running a good second. FDR is now WLJI and keeps 7 schedules daily. MN will have his 20th anniversary as a ham in January and keeps 11 schedules daily. CVQ put up new antenna for all bands. GUY is building 1.75-Mc. 'phone. GST is new O.P.S. BOY reports for Corpus Christi. DXE has 28-Mc. mobile transmitter in his auto. EBP is active on 14-Mc. 'phone. EVA has new Super Sky Rider. ZX is on 28-Mc. 'phone. DSH is building portable for hunting camp. FNH gets S9 reports on 14-Mc. 'phone from DX stations. TF is active on 7 Mc. BSF is putting up 28- and 14-Mc. beam. FLB got on with 30 watts on 28-Mc. 'phone. FNE has a pair of '45's on 7 and 3.5 Mc. DOB is active on 28-Mc. 'phone, and put up a swell V beam, at least ten full waves long on each leg. BYV is experimenting on "2½ meters." DB works 28-Mc. 'phone occasionally. GGC is moving to the 2nd Dist. We are sorry to lose you, OM. On Nov. 11th the Sabine District Radio Club held a meeting in Beaumont, with the Galveston and Houston Clubs present; Port Arthur was represented by DEW. Nov. 15th the Galveston Radio Club had a large meeting at showing of the A.R.R.L. moving pictures. Nov. 18th the Houston Amateur Radio Club showed the A.R.R.L. picture to large attendance. FFP changed QTH and is on 14,004 kc. GWL is building 50-watt rig for 28-Mc. 'phone. CCU is building 1-kw. rig for 14- and 28-Mc. 'phone. GGE keeps the air hot at Texas A. & M. College on 3.9-Mc. 'phone.

Traffic: **W5**OW 1743 FDR 550 MN 524 CVQ 76 DLZ 72 GUY 5 GST 4.

NEW MEXICO — SCM, Joseph M. Eldodt, W5CGJ — ENI is busy on T.L.'s "M" and "AP" and National T.L. Net. ZM keeps the ball rolling over his way.

Traffic: **W5**ENI 38 ZM 9 (WLJG 24) ZU 1.

SOUTHEASTERN DIVISION

ALABAMA — SCM, James F. Thompson, W4DGS — R.M.'s: 4APU, 4DS; P.A.M.'s: 4DHG, 4BMM; E.C.'s: 4OA, 4ECI, 4CRG; O.O.: 4EBZ. For the information of all interested, here is a list of A.R.R.L. appointees in Ala. in addition to the above: O.R.S.: APU, CJG, DQW, DS, DXI, EDR, EFR, ECP, FLS, ERW, AAQ, CRG, O.P.S.: AUP, DHG, EDR, EEU, FAZ, DGS. O.B.S.: DHG, EBZ, CRG. The Tusky gang has gone in for emergency planning under leadership of CRG, the E.C. for the Warrior water-shed. All hams along that line should contact CRG. CRG has appointed Asst. E.C.'s: CCP and CPE for Gorgas and EUZ, EYV and ELX for Tuscaloosa and vicinity. The following Tusky and vicinity stations applied for Emergency Corps membership: FAJ, EQG, EUZ, AKP, EYV, ETL, FJK, ELX, DAQ, FSA, BEB and EJZ. They have a rig now with a 6L6 and vibrator power supply and, in addition, the paper mill there makes its own 110 a.c. which can be tapped in an emergency in the event higher power is needed. FSA is new call in Tusky. A bunch of the Tusky gang visited the Gorgas crew at CCP who is helping in the emergency work. EYV, ELX, and CRG joined the A.A.R.S. under DQW. There is still a need for some A.A.R.S. members in So. Ala. How about it, Dotha, Troy and Mobile? BFU celebrated his 13th year as a ham in Ala. under calls 5ANJ-4AJB and now BFU. EKI visited KB and LT; he has new 28-Mc. rotary beam and new preselector. BCU is trying 56 and 28 Mc. with AIY and his airplane. BLG still opens 3.9 Mc. with that kw. CVM is 1.75-Mc. 'phoning with T55 final. BMM has new antenna with 60-ft. poles and rebuilt the 14-Mc. rig to 28 Mc. DBH is back on 3.9 Mc. EIB and EAY represent the capital city on 1.75 Mc. EIB is building a CHT modulation control with new crystal mike. ELX applied for O.R.S. APU reports for B'ham: ERW is building emergency rig and holds down A.A.R.S. FGF has 600 watts on 1.75, 800 watts on 28 Mc. with 4 half-waves. ECI reports DX pouring in at Shades Manor. EHH reports 51 countries, with CR7AF his best this month. ERX tried QRP on 1.75 Mc. and worked 8RLO with 6½ watts input. APU has e.c.o. that he says keys better than a crystal. He reports the B'ham Club busy sealing the club house and CUE, the club station, meeting the L. & N. Net. FMR is sweating for a W.A.S. CIU reports: BWG can't understand why anyone wants a crystal when his P.P. '45's TNT does just as well. EBD has new Breting 9. CIU visited FHO at Huntsville and helped him work his 45th state. DHG reports for Mobile: FRT on 3.5 Mc. is new call on Mobile Club. The Mobile Club is proud poppa of a Howard 12 receiver. Active stations on 'phone: CNI, ZZH, NU, DMO, CIQ and DHG — all on 1.75 Mc. FMI, FMH, FRT, DMQ and CBI are on 3.5-Mc. c.w. COU is on 7 and 14 Mc. EHJ is getting up three-element beam at new QTH. OA is brain-storming over a kw 'phone for 14 and 3.9 Mc. with push-button freq. control, etc. DHG has a centerfed zepp with 430-foot feeders; it's doing fine on 14 Mc., and we can vouch for it on 1.75 Mc. — the best signal ever out of Mobile on 1.75.

Ham at 30° Below

(*Continued from page 12*)

even your duffle bag of clean clothes mildews through, when the tubes collect "blizzard blankets" and the cartons become moist and damp, when your tools and other metallic objects rust in the damp salt air—then you begin to appreciate the precautions required.

Then, too, you must have power to operate. We used a gasoline engine for generating our power. One after another, replacement coils and condensers would go out. We finally had to revert to old Model "T" spark coils, reducing the primary power to lessen burning. Another point is to make sure that your lubricants will function at the temperatures you will encounter. Ours would not, and it was some chore to drain the coil and water immediately after each run, and then reheat it on the stove before starting up again!

Yes, there are two sides to the picture, all right. I certainly had plenty of illusions shattered on this trip. Don't you believe all the bunk they paint about the glory and glamour of expedition life! Just salt it down that expeditions are about nine-tenths good, hard work and about one-tenth bunk. My private opinion, after having spent a little time "up North," is that it is not worth while for an amateur to want to waste a year of his life out in the great unknown, away from the warmth of his family fireside, from clean rooms and hot baths and three square meals a day, from friends and companions, from all that one has come to enjoy and appreciate of civilization. True, it will be different from the humdrum of everyday life. You can be sure of that! You have to rough it and take life as it comes. Whether it be in the tropical heat with insects and jungle fever and vegetation impeding your progress and endless rain to soak up your cheery disposition, or whether it be in the chill of the Arctic with winds biting your serene self and freezing this and that part of your anatomy, snow blowing into your eyes and freezing out visibility so that you cannot help but stumble and fall—wherever it may be, remember that it simply means long, discouraging hours of hard labor under conditions that would be intolerable at home.

Think of having to put up an antenna that has blown down, when it is pitch dark twenty-four hours a day and the temperature is from 10° to 30° below zero, with a howling Arctic wind so strong it almost bowls you over—or think of starting an engine so cold you can barely turn it over every time you have a schedule to keep—or of living closely confined with a group of men with whom you continually rub elbows all day and night for months on end, or of monotonous meals providing the same scanty fare every day, day after day. Think of having to do with and put up with things that are far worse than anything you could expect at home, of doing everything the "hard way"—and then, if you still want to go, this is all I have to say:

More power to you!

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Model 450A—12 Tubes—6 Bands—Frequency Coverage .54 to 65 MC . . . Ceramic Coil Forms . . . Dual I. F. Channels . . . Two S. L. F. Ceramic Insulated Tuning Condensers . . . 47 inches of electric bandspread . . . crystal filter . . . Calibrated 'R' Meter . . . Accurately calibrated direct reading dial . . . Price, with Tubes, less Speaker, less crystal........**$87.50 Net**

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America's Oldest Radio Manufacturer

Vertical Antennas

(Continued from page 17)

the old single-wire feed method. The information covering this form of feed which is given in the *A.R.R.L. Handbook* may be applied to almost any of the foregoing antenna systems and will bring about a certain amount of simplification of the mechanical details. It would be hard to think of a simpler way of feeding almost any of the vertical systems which are made up of single or stacked half-wave units. More or less as an added starter and just to show how easy it is, we have added Fig. 7, which will be recognized as a simplification of Fig. 4-E. As a rule, single-wire feed is not suitable for rotary systems, for reasons which are strictly mechanical, so we have omitted previous mention of it.

Almost any of the quarter-wave Marconi aerials described in the first part of this text may be single-wire fed. Theoretically each of the quarter-wave units has for its other quarter-wave section either the building on which it has been erected or the ground. Many of those that we have used have been on high buildings, and possibly that is the reason for our having secured almost as good results with quarter-wave aerials as with center-fed half-wave units.

The quarter-wave antenna may be single-wire fed by considering the vertical portion as only half the antenna, and the feed line may be attached at a point approximately two-thirds the distance down from the top. It is sometimes thought that it is impossible to use single-wire feed without having standing waves on the transmission line. This need not be true because single-wire feed may be considered in exactly the same light as two-wire feed, the ground itself forming the other half of the line. Therefore the single-wire line may be used as a resonant feed system having standing waves[7] or a non-resonant system without standing waves. Where vertical aerials are to be used on apartment houses in localities where a great many broadcast receivers are in use, it is desirable to use the non-resonant line to avoid interference.

In the quarter-wave vertical, the point of highest current is at the base of the antenna. The point of lowest voltage is also at the base. This means that there is no need for an insulator at the base at all, and if care is taken in the selection of the feed system there is no reason why a vertical quarter-wave radiator cannot be mounted directly on the steel frame of a building without using insulation of any kind.

Combinations of Vertical Antennas

In all the antennas considered up to now, simplicity has been the keynote. It is perfectly possible to make combinations of vertical ele-

[7] Resonant operation is inadvisable in practically all cases because under such circumstances the line radiates practically as well as the antenna and is not, therefore, really a transmission line in the usual sense of the term. With non-resonant operation, the radiation is low because the line current is low, but the cancellation effect of the two-conductor line is lacking.—EDITOR.

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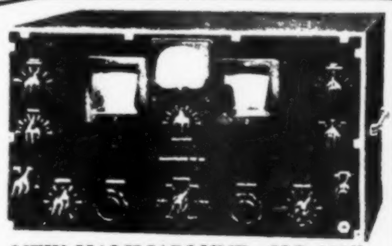

NEW HAMMARLUND "HQ 120"

Continuous range from 31 to .54 mc—12 tubes: antenna compensating control: 310° band spread: noise limiter follows A.V.C. for quiet reception: variable band width crystal filter for phone reception: calibrated "S" meter on all models.

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Made in accordance with standard specifications. Constructed of 1/8" steel, finished in fine black crackle.

1¾"	$ .39	12¼"	.79
3½"	.44	14"	.89
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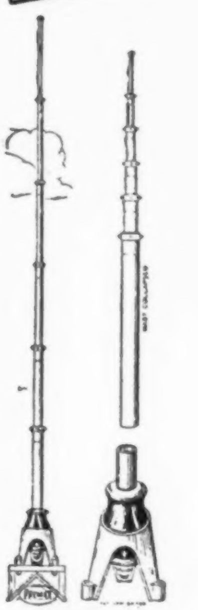
7"	.54	17½"	1.09
8¾"	.59	19¼"	1.19
10½"	.69	21"	1.29

Steel Brackets

Black crackle finish, 1/8" steel.

8" base (per pair) 44c
11" base (per pair) 59c
13" base (per pair) 69c



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Beat Frequency Oscillator 6577. Net	$1.18

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2 Mfds. 2000 volts **$1.49**

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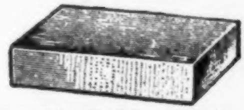
Oil treated. Excellent power factor and capacitance characteristics. Tested at 6000 volts DC.



Crackle Finished and Electro Zinc Plated Chassis

•5½ x 9 x 1½	35c	10 x 14 x 3	69c
5 x 10 x 3	39c	10 x 23 x 3	89c
6 x 14 x 3	49c	7 x 17 x 2	63c
•7 x 7 x 2	39c	7 x 17 x 3	66c
7 x 9 x 2	42c	10 x 17 x 2	69c
7 x 11 x 2	45c	10 x 17 x 3	75c
7 x 13 x 2	49c	12 x 17 x 2	79c
7 x 15 x 3	59c	12 x 17 x 3	85c
10 x 12 x 3	65c	13 x 17 x 3	89c

•Available in Zinc Plated only

THE RADIO SHACK 46 Brattle St., Boston, Mass.

ments to provide some very interesting effects. An outstanding example of the use of two half-wave verticals which could be made to transmit end-fire or broadside by the simple expedient of altering the connection between the transmission line and the feeding stubs was described by Dana Griffin, W2AOE, in *QST* for October, 1935.[8] The spacing which Griffin used between the vertical elements was quite different from the close spacing which is now so popular, and the advantages of the close spacing will be immediately recognized. A more recent outline of what is essentially the same idea will be found in *QST* for May 1938, under the title "Simple Directional Arrays using Half-Wave Elements," by Nicholas C. Stavrou, W2DFN.

Some very interesting information on the application of three vertical elements for use on 10 meters, as shown diagrammatically in our Fig. 6-B, will be found in an article entitled "A Continuously Rotatable 28-Mc. Beam," by A. F. Neuenhaus, W2BSF, and M. E. Schreiner, W2AJF, which appeared in *QST* for March, 1938.

The most outstanding example that we have seen of the way in which verticals can be used in a rotary beam is now in operation at the station owned by Frank Carter, W2AZ, at East Rockaway, Long Island. On top of a 60-foot telephone pole, which is unguyed, he has set up a pivoted crossarm made of two 2 x 10 planks mounted edgewise. On the top side of this crossarm are mounted two of the new Premax self-supporting 36-foot vertical telescopic radiators. Two similar radiators extend downward from the bottom. The four units have been worked into a vertical two-section "8JK" beam. Since the beam is bi-directional it is only necessary to provide 180 degrees of rotation for 360-degree coverage.

Using about 900 watts input, W2AZ has worked 100 countries on 'phone, using a single frequency in the 20-meter band. Some indication of the superiority of his vertical beam over the three similar horizontal beams that he has been using may be gleaned from the fact that VU2CQ in Bombay, India, can be received S8 on the vertical, when he is just audible on the horizontal beam. On a recent weekend W2AZ made WAC on 20-meter 'phone, and he now reports PK6XX in Dutch New Guinea S7 on the vertical beam, when he could not be heard on the horizontal beams at all. VQ3HJP in Tanganyika and TF5C in Iceland have been workable with this new vertical, after they had faded out completely on the horizontal beams.[9]

[8] D. A. Griffin, "Shifting Antenna Directivity by Phase Switching," *QST*, October, 1935.

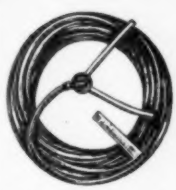
[9] These results are interesting in view of the fact that the only obvious explanation is that the signals were arriving with vertical polarization, since antenna systems having practically the same gain were used. Long-time observations on high-frequency waves have shown that on the average the polarization at the receiving point is horizontal although, of course, there are frequent exceptions. A possible alternative explanation is the difference in vertical characteristics of the systems; the vertical array is broader in the vertical plane than the horizontal array, so that the vertical might show large gain if the signals were arriving at relatively high angles.—EDITOR.

Bassett CONCENTRIC FEEDER

*NEWARK OFFERS THE LATEST IN ANTENNA EQUIPMENT - - - - -

Neither snow, nor rain, nor ice, nor sunshine, nor the gloom of the "XYL" can stay these husky cables from the efficient transfer of radio frequency power from transmitter to antenna.

Newark has a **BASSETT CONCENTRIC FEEDER** or **BASSETT CONCENTRIC TRANSFORMER** for every type antenna and for every power requirement. Order today direct from this ad.



Bassett Concentric Feeder

Bassett Concentric Transformer

Type	Power Rating	Surge Impedance	Price Per Ft.
BCF-64-5000	5000 Watts	64 Ohms	40c
BCF-64-1000	1000 Watts	64 Ohms	17c
BCF-64-500	500 Watts	64 Ohms	10c
BCF-64-200	200 Watts	64 Ohms	5c
BCF-34-1000	1000 Watts	34 Ohms	16c
BCF-28-1000	1000 Watts	28 Ohms	11c
BCF-13-1000	1000 Watts	13 Ohms	7c

Factory moulded and attached end seal, any length $1.50

50-75-100 ft. lengths with end seal on above carried in stock. All other lengths to order only.

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For feeding 3-element rotary beams. Both ends sealed at the factory. One end connects direct to center of antenna and other end direct to open wire line consisting of pair of No. 12 wires spaced four inches apart. Open wire line to transmitter may be any length desired. BCT-10 for 10-meter band. BCT-20 for 20-meter band. Three power ratings as indicated.

BCT-10-1000	$4.15	BCT-20-1000	$5.00
BCT-10-500	3.75	BCT-20-500	4.25
BCT-10-200	3.45	BCT-20-200	3.75

Prices include factory attached seals at both ends.

All Items Carried in Stock

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BCF-8-1000—Special 8-Ohm, 1000-Watt line for direct feeding of 3 element rotary beam antennae.

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3-Element, 20-Meter Antenna $22.50
3-Element, 10-Meter Antenna 15.50
2-Element, 20-Meter Antenna 15.50
2-Element, 10-Meter Antenna 10.50

These elements are of self-supporting, reinforced lightweight steel, factory cut to correct length, 1″ in diameter, and are copper-plated both inside and outside and heavily lacquered. Weight is approximately two ounces per foot.

The above prices include necessary elements, white lacquered wood supporting members, factory mounted insulators, and all necessary hardware.

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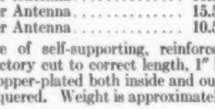

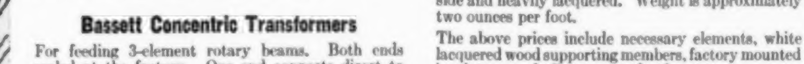

NEWARK ELECTRIC COMPANY

323 W. MADISON ST. CHICAGO, ILL.

The Cairo Regs

(Continued from page 30)

signals or a code word, and will be used for the transmission of information that may be used only by persons so authorized, such as the subscribers to a press service.

Remember the scheme for classifying types of emissions, wherein A3 is telephony, etc.? There are a few changes there worth noting. The basic uninterrupted carrier, of course used only in special cases such as standard-frequency emissions, is now spoken of as a Type AO continuous wave. Type A1 remains c.w. telegraphy, Type A2 modulated telegraphy, Type A3 telephony. Facsimile is now to be designated Type A4 and television becomes Type A5 emission.

There are a few changes in the prefix letters assigned nations for their calls, but these have been reported as current news as they went into effect, and they appear in detail in the periodical revisings of the I.A.R.U. country list, the prefix listings in the *Handbook*, etc.

That's the works, as far as things interesting to us are concerned.

Another Method of Keying

(Continued from page 31)

cycle and the grid can regain control. If a controlled rectifier is placed between the center-tap of the plate transformer and the filter, the current through the tube will look like Fig. 1-A if choke input is used, but it will look like Fig. 1-B if condenser is used. Thus with condenser input the current from the transformer center-tap flows in only one direction but is reduced to zero 120 times every second, and a single controlled rectifier can be used to key the circuit. The keying will still be through the filter and will retain the characteristics of rectifier keying with a saving of one special rectifier tube. Since condenser input and a minimum of filter are normally used with primary or rectifier keying, no changes are necessary in the circuit other than the introduction of the keyed rectifier tube and its control circuit.

In Fig. 2, an adaptation of the primary-keyed system described by W6CUH,[3] the driver and final amplifier are both keyed, and no bleeder is used on the final power supply (except a voltmeter or very high resistance so that the filter will gradually discharge and prevent accidental shock). This system has the advantage that with the key up the voltage on the final amplifier is a little below what it is with the key down, and no thumps are introduced by regulation of the final amplifier power supply. If the keyed driver stage put no "tails" on the characters the final amplifier supply voltage would always remain exactly the same, key up or key down, but with the keying described the voltage will drop somewhat in the "key up" position, depending on the storage in the driver stage supply. Any of the usual methods can be used to control the rectifier

[3] *QST*, March, 1937, p. 31.

tube[1,2]—the one shown is used because the well-insulated bias-supply transformer was on hand.

The system is in use at W1JPE, and the 150-ma., 1700-volt, driver supply and 350-ma., 2800-volt, final supply are handled easily by any of the control tubes available.

[1] *QST*, Feb., 1938, p. 34.
[2] *QST*, Sept., 1938, p. 42.

Selectivity With the 2-Tube Regenerative Receiver

(Continued from page 37)

parison between receivers is to take a case when two incoming signals are so close in frequency that the difference is well down in the audio range, then to see which receiver makes copy of one of them possible. This comparison was made between the pee-wee and a well-known superhet with a crystal filter and repeated day after day. It is still uncertain whether the super shows much, if any, superiority. This would indicate rather unexpected selectivity.[3]

W8QBW, located in a suburb of Detroit, is in the basement, practically underground. The "ground" is a galvanized pipe passing through the floor into permanently damp earth. To this pipe is bolted a piece of half-inch brass pipe which runs along the edge of the shelf so that ground is brought right up to the receiver. The ground wire from the set is only a few inches long. This may be an important point, but the set was also tested on the second floor, with a steam radiator ground, and they came rolling in just the same.

The power supply for a regenerative receiver needs some attention. The one here has three chokes and three condensers and is satisfactorily quiet.

Referring to the photographs, on the left side are the power-supply and 'phone plugs, in front are the band-spread and band-set dials and on the right side are the antenna and ground posts and the potentiometer knob. On top the arrangement is self-explanatory. In the underside view, with the condenser dials at the left, will be seen the two midget variables; in the center is the audio choke, in the corners condensers C_6 and C_7 (with R_4), at

[3] This particular superhet is of the type without a selectivity control, and depends upon the phasing control for variation of effective selectivity. The crystal input circuit is normally factory-adjusted to a relatively broad setting, so that the audio peak on a c.w. signal is not nearly so sharp as it would be on a set having the crystal selectivity adjusted to a high value. Under these conditions the comparison is not so far-fetched as it might seem at first glance, since with both receivers separation of signals having nearly the same beat note is mostly a job for the selectivity of the ear rather than that of the receiver. The regenerative set's selectivity is higher than usual because it is dealing with signals of small amplitude compared with those furnished by the conventional antenna. It is therefore working under considerably more favorable conditions than it would be with a large antenna, or if it had been preceded by an r.f. amplifier. Of course, the "other side of zero beat" is not eliminated, as it is in the crystal super. — EDITOR.

the right is RFC and below this, not visible, are C_4 and C_5. At the top of the photo is the potentiometer, R_2, and at the bottom are the power socket and 'phone jack. R_6 is across the 2.5-volt prongs of the power socket and cannot be seen. You cannot install the parts and then connect up — there isn't a chance to get at some of them. Leads should be soldered to the hard-to-get-at points and some of the parts made up into little "assemblies" so that after installation there is not much left to do. In fact this method is really easier than the usual way. Grounds are made right on the spot; for example R_4, R_5 and R_6, and the end of L_1 are grounded on the socket screws.

Anyone who builds this set is urged to make the chassis from the illustrated template and follow the placement of parts exactly. You can't tell just what may happen if a rig is made up differently from the original; it might be an improvement but frequently is otherwise.

What has been said applies entirely to c.w. performance. I would not offer the set for 'phone although I did hear some Florida, Texas and West Coast 'phones on 10 meters during the day, with the 12-inch antenna.

Television Receiver

(Continued from page 52)

control is set to give a suitable average illumination of the entire picture. Further adjustments of the tuned circuits, a.g.c. control, and focusing controls will aid in bringing up the picture detail, until optimum settings are found for all adjustments and controls.

For locations where the signal level from the antenna is apt to be low, the final steps in the alignment of the picture receiver can be helped along by means of a calibrated "5-meter" oscillator, provided with sound modulation. The oscillator, tuned to 46.5 Mc., is loosely coupled to the receiver, which can be tuned to the oscillator frequency by observing the moving, unsynchronized band pattern on the Kinescope. The number of dark (or light) bands observed corresponds to the ratio of the sound modulation frequency (of the test oscillator) to the vertical scanning frequency. The set is tuned by adjusting C_{12}, C_9, C_3, and C_8, in the order named. Maximum sensitivity for a specific setting of the a.g.c. and background controls will be indicated by the least average illumination of the Kinescope screen. The oscillator signal, however, should be kept small enough so that the Kinescope pattern never becomes excessively dark. When the picture signal is applied, the settings of C_3 and C_8 may have to be readjusted for best picture definition. Maximum sensitivity and optimum definition are not ordinarily obtained simultaneously, because the pass band may not be wide enough at maximum sensitivity to pass the full video band — that is, to give best picture definition.

The modulated test oscillator may also be used in the tuning of the sound receiver. If, after the picture receiver is aligned for maximum sensitiv-

THE A.R.R.L. EMBLEM

Insignia of the Radio Amateur

IN the January, 1920, issue of *QST* there appeared an editorial requesting suggestions for the design of an A.R.R.L. emblem — a device whereby every amateur could know his brother amateur when they met, an insignia he could wear proudly wherever he went. There was need for such a device. The post-war boom of amateur radio brought thousands of new amateurs on the air, many of whom were neighbors but did not know each other. In the July, 1920, issue the design was announced — the familiar diamond that greets you at the top of this page — adopted by the Board of Directors at its annual meeting. It met with universal acceptance and use. For years it has been the unchallenged emblem of amateur radio, found wherever amateurs gathered, a symbol of the traditional greatness of that thing which we call Amateur Spirit — treasured, revered, idealized.

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ity, the test oscillator is tuned 3.25 Mc. higher in frequency, the sound modulation should be quite audible on the sound receiver at a dial setting of about 9.75 Mc. The spacing of 3.25 Mc. between the video carrier and the sound carrier is shown in Fig. 1 in the preceding article. The tuning of the audio signal will be very sharp, due to the selectivity of both the sound receiver and the soundbuffer input circuit. If a tendency for the sound signal to drift is encountered, this may be due to frequency shift in either the sound-receiver oscillator or the picture-receiver oscillator. This effect can be minimized, provided the sound receiver is sufficiently sensitive at 9.75 Mc., by shunting a resistance across the sound-buffer input circuit. This resistance tends to broaden the tuning of the sound buffer stage.

In photograph "G" is shown a picture taken directly from the screen of the type 1800 Kinescope. The video signal, obtained from a Monoscope, was used to modulate a television signal generator, the output of which was fed into the r.f. stage of the picture receiver. Thus, the received picture illustrates the fidelity of which the receiver is capable. In the laboratory model of the receiver built as described, a resolution of better than 350 lines has been obtained with Kinescope Type 1800. This means that the receiver is capable of much better resolution than it is possible to obtain with small Kinescopes such as the 913, 902, and 906 (see page 22, *QST*, October, 1938). However, these smaller tubes will give quite acceptable pictures and will serve nicely the television amateur who is desirous of getting started with the minimum of expense. The picture receiver will justify, at a later date, the use of one of the larger Kinescopes.

The electromagnetic Kinescope and scanning units using Type 1800 Kinescope and shown in the complete receiver photographs in December *QST*, will be described by Mr. Sherman in a subsequent issue.

Bibliography

[1] "The 954 as a Vacuum-Tube Voltmeter," *QST*, May, 1935, pp. 90–92.

[2] "Type 726-A Vacuum-Tube Voltmeter," *The General Radio Experimenter*, May, 1937.

Strays

After reading this, 'phone ops with difficult call letters should end their complaining: W9YVZ and W9YZV, both in Chicago, recently had a 160-meter 'phone QSO!

Affiliated Clubs

(*Continued from page 32*)

300-watt gasoline-driven a.c. generator for emergency use.

The Connecticut Brass Pounders Association, W1CBA, has obtained an air-cooled gas engine to drive its a.c. generator, and plans to have a permanent emergency power supply.

In recognition of the service rendered the city of Hartford, Conn., during the hurricane and flood, the Hartford County Amateur Radio Association now has a permanent meeting place in the Chamber of Commerce Rooms, 805 Main Street, Hartford, through the coöperation of the C. of C. and support of the local amateur parts distributors. Plans are under way for a permanent club house on the outskirts of the city. A 300-watt 'phone and c.w. transmitter is about to be constructed for all-band operation and suitable receivers purchased. A drive is to be made for the construction of many emergency transmitters and receivers, operating independently of the 110-volt a.c. mains. A suitable emergency power unit is to be obtained to furnish power for the club station. When all plans materialize, H.C.A.R.A. will have its own club house with plenty of room for beam antennas, etc., the 300-watt rig on all bands, emergency power, and a radio link with the club rooms in downtown Hartford.

Visit Your Local Club

Clubs are excellent places to get acquainted with radio amateurs and to participate in interesting discussions on our hobby. At A.R.R.L. headquarters there are recorded the addresses of several hundred amateur radio clubs affiliated with the League, their places and times of meeting. Why not drop in at your local club and "meet the gang"? Address the Communications Manager (enclosing 3¢ stamp, please) for data on affiliated clubs in your vicinity.

General Club News

June 19, 1938, was an outstanding day for hams of Eastern Ontario and adjoining districts. Under the auspices of the Ottawa Amateur Radio Transmitting Association, a hamfest was held on Shiek's Island in the St. Lawrence River. Over sixty hams from VE2, VE3 and W8 districts, together with YL's, YF's and Jr. ops, spent an enjoyable day. Among the events were hidden transmitter hunts on the 3.9- and 56-Mc. bands, relay race, rag-chewing contest, spelling bee in which DX prefixes had to be identified, nail-driving contest for the ladies, left-foot sending contest, treasure hunt, etc. The A.R.R.L. Canadian General Manager, VE2BE, was in attendance. The usual prize drawing brought activities to a close. The success of the affair was due to the efforts of the committee: VE3MX, VE3ABH, VE3AJB, VE2GP and VE3BY. . . . The Westlake Amateur Radio Association is now meeting at the Harding Junior High School, Lakewood, Ohio, every other Thursday, 8:00 P.M., and invites nearby hams to drop in. . . . At the October 28th meeting the Olney Amateur Radio Club, Philadelphia, enjoyed a talk on radium by Dr. Henny of the Temple University Hospital. . . . The 56-Megacycle Minutemen officers are now as follows: G. R. Cogswell, W1AJW, president; R. E. Burditt, W1MJ, vice-president; A. H. Downer, W1DMS, secretary. Correspondence should be addressed to the secretary at 60 Willow Ave., Somerville, Mass. . . . VE3QB sends an interesting item which appeared

Where to buy it

A directory of suppliers who carry in stock the products of these dependable manufacturers.

super skyrider — hallicrafters — ultra skyrider

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- **BOSTON, MASS.** Radio Shack, 46 Brattle Street
- **BOSTON, MASS.** 110 Federal Street, Wholesale Radio Service Company, Inc.
- **BRONX, N. Y.** 542 East Fordham Rd., Wholesale Radio Service Company, Inc.
- **BUTLER, MISSOURI** 211–215 N. Main Street, Henry Radio Shop
- **CHICAGO, ILL.** 833 W. Jackson Blvd., Allied Radio Corp.
- **CHICAGO, ILL.** 901–911 W. Jackson Blvd., Wholesale Radio Service Company, Inc.
- **COLUMBUS, OHIO** 203 N. Fourth St., Bell Radio Parts Co.
- **DETROIT, MICH.** 325 E. Jefferson Ave., Radio Specialties Co.
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in the *Ottawa Journal* of May 23, 1912: "The Dominion Amateur Wireless Association of Ottawa was organized 'to promote interest in wireless telegraphy and to encourage the installation of amateur wireless stations.' . . ." Do any amateur clubs now in existence date back that far? . . . The Tenth Annual Michigan Hamfest (May, 1938), under the auspices of the Detroit Amateur Radio Association, met with the customary success, attendance being well over 600. Besides staging the Michigan Hamfest each year, the D.A.R.A. is justly proud of its record of the issuance of the D.A.R.A. Bulletin, published monthly for more than seven years without missing a single edition. This bulletin is mailed free to all operators reporting to the Michigan S.C.M. D.A.R.A. has also aided in the organization and maintenance of the well known Michigan (QMN) Traffic Net on 3663 kc. . . .

— E. L. B.

New Apparatus

Concentric Cable Kit

Kits for assembly of ½-inch diameter coaxial cable for lengths of 10, 25, or 50 feet, including inner conductor, outer shield, clips, screws, nuts, eyelets, and assembly instructions are now available from the Transducer Corporation, 30 Rockefeller Plaza, New York City. Ceramic spacers are used to maintain a flexible wire centrally located in a braid outer covering. Different wire sizes may be substituted to obtain various impedances, the size of the wire being limited only by the diameter of the spacer openings.

In the assembly process, the spacers are first strung on the length of inner conductor to be used. The braid is then opened in just the same manner as used for putting flexible braid shielding on hook-up wire, and the inner conductor and spacer assembly is pulled through the outer shield. After the outer conductor is tightened firmly on the spacers, screw clamps are used to secure the ends and complete the assembly.

Dummy Load Resistor

A new 100-watt constant-resistance dummy load resistor is now made available for amateurs by the Ohmite Manufacturing Company. Available in either 73 ohms or 600 ohms resistance, this unit is practically non-inductive for frequencies as high as 15 megacycles. The two resistances in which the resistor is made available match it to standard concentric, twisted-pair, and open transmission lines. Because the resistance of the unit remains almost constant at varying power up to 100 watts load dissipation, the resistors are well suited to use in series with r.f. ammeters for approximate measurement of r.f. output power of stages in the transmitter and of the power actually delivered to the antenna through the feed line.

The resistance element is enclosed within a glass globe which is evacuated and gas filled. The assembly is finished by addition of a ceramic 4-prong tube base, with the resistance element connected between the filament pins, so that a single dummy resistor may be made readily useful for a variety of applications by inclusion of 4-prong sockets at desired points in the transmitter.

— T. M. F.